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NASA CR-
144481

The SKYLAB Concentrated Atmospheric Radiation Project

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CR - 144481

Contract T-4714B

Final Report

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September 1, 1975

To

L. B. Johnson Space Center
National Aeronautics and Space Administration

N76-18615

(E76-10195) THE SKYLAB CONCENTRATED ATMOSPHERIC RADIATICN PROJECT Final Report (National Oceanic and Atmospheric Administration) 138 p HC $6.00 CSCL 03B

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G3/43 00195

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THE SKYLAB CONCENTRATED ATMOSPHERIC RADIATION PROJECT
CONTRACT T-4714B

P. M. Kuhn, W. E. Marlatt, and V. S. Whitehead

In conjunction with SKYLAB measurements, data were obtained at Earth's surface, in the boundary layer, and from aircraft, to be used to improve understanding of radiation transfer within the atmosphere. Measurements included total net radiation, albedo and temperature of the interface, atmospheric profiling of atmospheric radiative flux and layer cooling, and aerosol density, size, and distribution; total extinction coefficients were calculated. Instrumentation for observations is described. Data from radiometersonde observations, and the computer listings of the data are included in Appendices. Models for computing atmospheric IR transmission are compared. Spectral estimates of planet albedo are given and compared with SKYLAB observations. Performance of models is evaluated, and recommendations are made regarding the need for further studies.

1. INTRODUCTION

Participants in the SKYLAB Concentrated Atmospheric Radiation Project (SCARP) utilizing the Earth Resources Experiment Package flown on SKYLAB were Dr. P. M. Kuhn of the NOAA, Environmental Research Laboratories, Dr. W. E. Marlatt of the Department of Earth Resources, Colorado State University, and Dr. V. S. Whitehead of NASA, Earth Observations Division of Johnson Space Center. These were joined in the Phoenix field measurements by R. F. Pueschel of the NOAA Environmental Research Laboratories and L. Edwin Williamson of the White Sands Missile Range, New Mexico.

1.1 Approach

The ultimate purpose of the project was to arrive at a more complete understanding of radiation transfer within the atmosphere, including the contribution of aerosols to this transfer. Intermediate goals were as follows:

1. To acquire data giving a comprehensive description of the atmosphere's structure and composition over sites of differing radiation properties for a variety of air masses. Our measurements were taken at the surface and at levels between the surface and the spacecraft to support the SKYLAB infrared spectrometer, and scanner measurements of selected sites.

2. To acquire and implement several models of radiation transfer for both visible and thermal regions; and to test these models against observations.

3. To apply the result of these tests to improve models for the variety of existing air masses and atmospheres.

Data were acquired in two related experiments, in which a variety of measurements were taken (1) at the Earth's surface and in the boundary layer, and (2) from aircraft. A number of existing radiative transfer models allowed for varying air masses and amounts of wet and dry aerosols.

It was anticipated that other investigations could make use of the data base acquired. Hence the experiment was declared an open one and other investigators participated on an exchange-of-data basis. Among them were Ed Williamson of White Sands Missile Range and Rudolf Pueschel of NOAA's Atmospheric Physics and Chemistry Laboratory. Data exchanges occurred with EPA which provided a lidar in the first field effort, with the Texas Air Control Board for data acquired in the Houston area, and with other SKYLAB investigators.

To acquire the desired variety in the data base, sites were selected and data acquired onshore and offshore in the vicinity of Houston, Texas, to provide a warm moist clean and a warm moist dirty atmosphere; over White Sands Missile Range, N. M., (both sands and the mal pais) to provide extremes of surface characteristics for a clean dry atmosphere; and over Phoenix, Arizona, to provide hot dry clean and hot dry dirty atmosphere. Other sites surveyed (San Francisco, Four-Corners, and St. Louis) were not used because of operational constraints, primarily those of weather.

1.2 Acquisition of Data

Each field effort differed somewhat from the other in the type of data acquired as the investigators attempted to apply the experience of the preceding effort. Description of a typical exercise follows.

1. Personnel and equipment were moved to facilities nearest to the points of the field effort about three days prior to the scheduled SKYLAB overflight. Last minute changes to the operation plans were made.

2. Two days prior to the SKYLAB overflight a low key field effort was initiated primarily to check out equipment and procedures. During this day one or more radiometersonde releases would be made by P. M. Kuhn and Associates. Surface meteorological and radiometric measurements would be made at more than one site. The Colorado State aircraft would fly at least one multiple level pattern between sites with sensor operating for general familiarity, timing, and instrument test. This days' effort would be concluded by a general debriefing on problems and re-planning where desirable.

3. On the day prior to the SKYLAB overpass, a schedule was followed identical to that planned for the day of the overpass. The schedule included hourly, or continuous measurement of the following:

(1) Downwelling and upwelling solar flux.

(2) Direct beam solar radiation and albedo.

(3) Total net radiation at the surface.

(4) Radiation temperature of the surface, sky, and cloud.

(5) Wind, temperature, and dew point.

(6) Sky cover (photographs).

(7) Radiometersonde profiles (temperature, dew point, up- and downwelling thermal radiation, and layer cooling) each three hours.

(8) Interface temperature measurements from ground and helicopter.

(9) Aircraft profiles from near surface to above the haze layer (profiles of aerosol number density and size distribution, upwelling and downwelling solar flux, and profiles of temperature and dew point). Three times daily: early morning, at time of day of SKYLAB overpass and late afternoon. If the time of day of SKYLAB overpass differed greatly from the time of maximum surface heating another flight would be attempted at that time.

4. On the day of the overpass, the same schedule was followed, with the addition of the SKYLAB crew's participation. Because the SKYLAB data had to be acquired within 30 seconds, the crew had been provided photographs of measurement sites, to aid in recognition and fast response when the spacecraft passed over the site. SKYLAB data were obtained for us with an S190A multispectral camera, an S190B mapping camera, an S191 spectrometer, and an S192 multispectral scanner. The camera and scanner system were pointed at nadir in the Z-local vertical mode. The spectrometer, however, could be directed to point at a specific site by the operator to acquire several spectral scans. It should be noted that late in the planning stages for SCARP, the opportunity to use a helicopter mounted S191 spectrometer was accepted and profiles from near-surface to 12,000 feet were acquired for the same sites as those observed by SKYLAB.

5. It was initially planned to maintain the same observation schedule the day following the SKYLAB overpass as on the two days preceding in order to take advantage of the established field deployment to acquire data from more varied air masses. This was discontinued about midway through the field program for efficiency in scheduling. Exercises were then terminated about 24 hours after the SKYLAB overpass with only a single, or at most, two flights by the Colorado State University aircraft and one or two radiometersonde releases on that day. The exercise was concluded with a review of the effort and suggestions for planning of the next field exercise.

2. SURFACE AND BOUNDARY LAYER EXPERIMENT (NOAA)

P. M. Kuhn and L. P. Stearns

2.1 Instrumentation

2.1.1 Precision Radiometer

The Barnes PRT-5 radiometer was used for measurements of the interface temperature at the various SKYLAB sites. It consists of an optical unit and an electronic unit with interconnecting cables. The optical unit compares the amount of energy emitted by the interface with that emitted by an internal, controlled reference. The electronics unit converts the comparison into a voltage that can be recorded or read on a front panel meter. The detector is a hyper-immersed thermistor bolometer in a reference temperature cavity. Lenses restrict the spectral interval measurements from 8-14 microns. The instrument accuracy is 0.5C and the response time varies with the setting of an adjustable bandwidth setting from 5 to 500 milliseconds. The field of view is approximately 2°.

Effective radiance (N_{eff}) is defined as

$$N_{eff} = \int_0^\infty \frac{R_x}{R_{pk}} N_{BB} \, d\lambda, \tag{1}$$

when $\frac{R_x}{R_{pk}}$ is the normalized spectral response of the instrument and N_{BB} is the black body radiance.

2.1.2 The Radiometersonde

The radiometersonde used for soundings of the atmospheric temperature, pressure, relative humidity, and hemispheric radiation flux profiles, looking upward and downward at the various SKYLAB sites, was a combination of the Suomi-Kuhn Economical Net Radiometer attached "piggy back" to a standard balloon-borne radiosonde. The radiometer is a double-faced hemispheric bolometer with broad-response blackened sensing surfaces at night, white in the sunlight, shielded by two thin polyethylene membranes. The sensors used were rod thermistors with precalibrated constants. Flux evaluations are made for 0.5-micron spectral intervals to compensate for the irregularity of the blackened surfaces. The unit is attached to a radiosonde in a horizontal manner with a sequencing device enabling the data from the radiometer to be recorded in sequence with that of the radiosonde. These data from the balloon-carried radiometersonde are transmitted by a 403-MHz transmitter to a ground receiving location and recorded on a strip chart. At the White Sands and Phoenix sites, the transmitter was a 1680 MHz unit.

The frequencies representing temperatures were recorded and changed to temperatures based on the expression

$$f = \frac{F_{ref} \times R_{ref}}{R_{therm} + R_{ref}} \qquad (2)$$

where R_{ref} is the resistance of the modulator equal to 44.9 kilohms and F_{ref} is the frequency of the modulator at this resistance equal to 190 cps or 95.0 frequencies on the strip chart record.

The flux at any pressure level, looking upward or downward, may be obtained by the equations

$$F\downarrow = \sigma T_t^4 + A[-k_i(T_b - T_t)/D - k_t(T_a - T_t)/d] + \lambda d\ T_t/dt,$$

$$F\uparrow = \sigma T_b + A[+k_i(T_b - T_t)/D - k_b(T_a - T_b)/d] + \lambda d\ T_b/dt,$$

and $F_{net} = F\uparrow - F\downarrow$.

Since A, B, k_i, k_t, k_b, σ, λ, D, and d are all defined constants, it remains only to measure the parameters T_a, T_t (top plate temperature), and T_b (bottom plate temperature) to determine the radiant fluxes with the predetermined log term based on the time, t. Once the net radiative flux is calculated, an additional term may be computed, that of the uncompensated atmospheric layer warming/cooling (W). It may be expressed as

$$W = -\frac{g\ (F_i - F_{i-1})}{C_p\ (P_i - P_{i-1})} \times 1440 \ , \qquad (3)$$

where g is the acceleration of gravity, C_p is the specific heat at constant pressure, and 1440 is the number of minutes in a day. The error of the instrument is 7 watts per square meter.

2.1.3 The Net Radiometer

The Suomi-Franssila-Islitzer Net Radiometer was used for measuring the net flux of radiation energy through a surface parallel to the Earth's surface at the SKYLAB sites. This instrument has a specially designed vane in the nozzle throat and an electric heater to furnish a sensitive control over the ventilation so that the cooling power in each side of the plate can be equalized. The sensing range is from 0.17 to 80 microns from a sensor consisting of a glass plate wound by 360 spaced turns of copper and constantan wire to form a thermopile after proper plating and blackening. About six percent of the entire surface of the blackened sensor is also coated with a strip of highly reflective white paint to compensate for solar radiation. The resistance of the thermopile is read directly from the calibrated sensor and is recorded in millivolts. It is capable of measuring total net radiation to within an accuracy of 2 percent.

2.1.4 The Pyronometer

The Model 2 Eppley Pyronometer was used to measure the incoming solar radiation and albedo at the SKYLAB ground sites. This is a precision pyronometer incorporating a fast-response, wirewound, plated with copper/constantan, temperature-compensated thermopile and two miniaturized hemispheres of WG 7 glass. It was calibrated against standards verified against the Eppley primary reference group (Eppley-Ångström electrical compensation pyrheliometers) which maintains and reproduces the International Pyrheliometric Scale in the United States.

2.2 Radiometersonde Observations

During SKYLAB Phases II, III, and IV, 28 radiometersonde ascents were made before, after, and during the overpass times of the satellite laboratory. They occurred in the oil fields near Rosenberg, Texas; at White Sands, New Mexico, at both the lava area and the sands area; in the desert near Phoenix, Arizona; and finally in St. Louis, Missouri. At the last site, no SKYLAB measurements were made, but our data are included. Table 1 is a list of the ascents with comments.

2.2.1 The Data

In Appendix A are the data plotted by a CRT unit of CDC 6600 of the ascents. Air temperature is denoted by T, upward radiant flux by Δ, downward radiative flux by ∇, net radiation flux by O, warming/cooling by C, and humidity by M. Here langleys/min may be rewritten cal $cm^{-2}min^{-1}$. The computer plots the humidity in gm kg^{-1}, using the radiation scale.

Appendix B is the computer listing of the data in Appendix A. Column headings are provided and again ly/min is equivalent to cal $cm^{-2}min^{-1}$. The relative humidity is in percent. In flight number one, only, the radiative flux profiles are invalid and only the pressure, temperature, and moisture profiles should be considered.

2.3 Thermal Radiation Calculation Model, Program Radiance

The infrared radiation transfer program RADIANCE has been developed and modified to include ten options, all involving use of the radiative transfer equation. The program takes into account transfer through aerosols, the latest measurements of carbon dioxide, water vapor, window regions, and ozone. Therefore, radiance and irradiance may be determined for any infrared spectral interval to one inverse centimeter and at any angle either to include or to exclude aerosols or carbon dioxide. It may calculate blackbody equilibrium temperatures, spectral intervals, weighting functions, brightness (apparent) temperatures, net irradiance, and profiles, or it may be inverted to infer water vapor at specified levels when only the temperature profile is known. Appendix C is a logic flow chart of the program and Appendix D is a listing of the program.

Table 1. Radiometersonde Ascents

No.	Date	Location	Time	Weather/Clouds	Comments
1	6/04/73	RNB	1300 CDT		Air temps only
3	6/05/73		0537 CDT		
5	6/05/73		1713 CDT		
6	6/06/73		0855 CDT	5Cu	
7	8/07/73	RNB	1715 UT	5Cu 2Ac 2 Ci	
8	8/07/73		2212 UT	35 ϕ Cu 7 Ci	
9	8/08/73		0146 UT	9 Ci	Nite
10	8/08/73		1438 UT	2 Cu 30, 1 Ac 120, 1 Ci	
11	8/08/73		1600 UT	4 Cu	Overpass
12	8/08/73		1937 UT	4 Cu 30, 4 Ac 120, 2 Ci	
13	8/09/73		1516 UT		
14	8/09/73	BUC TWR	0835 CDT		
15	8/11/73	W.S. LAVA	2138 UT		
16	8/11/73		0000 UT		
17	8/12/73		1432 UT		
18	8/11/73	W.S. DUNES	2130 UT		
19	8/11/73		2400 UT		
20	8/12/73		1437 UT		
21	9/06/73	PHX #5	0800 MST	0 Ac, Ci	
22	9/06/73		1015 MST	0 Ac, Ci	
23	9/06/73		1405 MST	0 Ac, Ci	
24	9/06/73		1900 MST	0 Ac, Ci	
25	9/07/73		0800 MST	Clear	
26	9/07/73		1130 MST	Clear	
27	1/18/74	ST. LOUIS	1250 CDT	5 Cc, Cs	
28	1/18/74		1535 CDT	E5, 10 Cu RW -	Thru front

2.3.1 Purposes of RADIANCE Program Sections

Radiance and irradiance. To determine the radiance and integrated irradiance values over desired wavelength intervals, angles and specified filters with input pressures, temperatures, and mixing ratios. This also provides the integral water vapor and the carbon dioxide and water vapor totals above or below the background pressure.

Black-body equilibrium temperatures. To determine the black-body radiance and normalized radiance for specified frequencies and filters over an input temperature range at specified intervals.

Spectral intervals. To list the radiance of each frequency of a band at ten inverse centimeter intervals.

Infrared weighting. To determine the quotient of the differential of the transmissivity for two levels divided by the differential of the natural logarithm of the pressure levels printed for each average pressure and temperature in a temperature versus pressure profile for each specified frequency and angle. Quotients are radiometric transmission weighting functions enabling one to determine "penetration" depth for a radiation observation in the atmosphere. Output includes punched cards of average pressures and quotients.

Atmospheric corrections to observed brightness temperatures. To adjust the apparent or brightness temperature of the background or interface, for specified intervals and angles. This procedure reconstructs the physical temperature of the interface.

Bignell method of determining aerosol contribution. To determine radiance and integrated irradiance using two absorption coefficients in the continuum at specific wavelengths following the method of Bignell (1970).

Aerosol. To determine radiance and integrated irradiance for specified layers in an atmospheric profile for different types and sizes of aerosols, using a bulk volume absorption coefficient.

Net integrated irradiance and layer warming/cooling. To determine the difference between the upward and downward irradiance, using the differential irradiance to determine the warming/cooling of a layer. Output includes punched cards of pressure, temperature, and layer warming/cooling.

Water vapor inference. To determine the total water vapor burden above the reference level and the mixing ratio at the reference level by inference of the radiative transfer equation. To determine the relative humidity at the reference level with respect to water.

Profiler. To determine a temperature or humidity profile from aircraft by measuring the radiance with assorted carefully chosen filters or at different angles by inverting the radiative transfer equation and using the already determined infrared weighting functions. Output includes cathode ray tube plot.

2.3.2 Method of Development of the Transfer Model

Determination of the radiance. The transfer of radiation observed or calculated at a reference level, r, in the atmosphere is given by

$$N_r = - \int_{\nu_1}^{\nu_2} \int_{\tau=1.0}^{\tau} \phi(\nu)\, B(\nu,T_a)\, d\tau\, d\nu + \int_{\nu_1}^{\nu_2} B(\nu,T_o)\phi\, (\nu)\tau\, d\nu, \tag{4}$$

where ν is the wavenumber,

τ is the atmospheric transmission in specified spectral intervals and, by the multiplicity theorem, is equivalent to

$\tau_{H_2O} \cdot \tau_{CO_2} \cdot \tau_{O_3} \cdot \tau_{continuum}$,

ϕ is the response function of the radiometer including the filter and detector transmission product,

B is the Planck function,

T_a is absolute temperature of an air layer,

T_o is the physical temperature at the surface, and

$d\tau$ is equivalent to $\tau_{i+1} - \tau_i$, where i refers to successive atmospheric levels.

With no atmosphere present Eq. (1) may be written,

$$N_o = \int_{\nu_1}^{\nu_2} B(\nu,T_o)\phi(\nu)\, d\nu. \tag{5}$$

The Planck body radiation expression is given by

$$\int_{\nu_1}^{\nu_2} B(\nu,T)\, d\nu = \sum_{\nu} (a\nu^3/\exp(b\nu/T)-1)\Delta\nu \tag{6}$$

where a is equal to 3.7413×10^{-5} erg $cm^2 sec^{-1}$ and b is equal to 1.4389 cm deg.

Combining Eqs. (2) and (3) permits the additional solution of T, the equivalent black-body or brightness (apparent temperature) given by

$$T = \sum_{\nu} b\nu/\ln\, ((\phi(\nu)\nu^3/N_o)+1)\Delta\nu. \tag{7}$$

Where, in the usual sense, an atmosphere is present, N_o must be replaced by N_r from Eq. (1) and the solution proceeds to T, a brightness or apparent temperature not equal to the physical temperature T_o given in Eq. (1). "T" is the required temperature of any interface. The brightness temperature T, is adjusted to give the true, physical temperature, T_o, by radiometric vertical profiling of the interface temperature through various atmospheres.

Addition of aerosols to model. (a) Bignell continuum transfer model: Water vapor continuum is determined as suggested by Bignell (1970) by using the total absorption coefficient at temperature T and total pressure p (p,e) by

$$k(T,p,e) = k_1(t)\ p + k_2(t) e \tag{8}$$

where k_1 is the absorption coefficient at unit total pressure for foreign broadening and k_2 is the absorption coefficient at unit partial vapor pressure for e-type absorption. (b) Particulates transfer modeling: The transmissivity of aerosols may be determined by

$$-\ln \tau = K \int dz \tag{9}$$

where K is the volume absorption coefficient, and z is the height of the layer specified.

Layer warming/cooling. It has been determined by Robinson (1950) that the use of radiance measurements at 52.5 degrees off zenith in calculating the irradiance or flux closely approximates the value of integrated irradiance over 0-90 degrees. The use of this angle then makes simple and inexpensive the computation of the net flux and consequently the atmospheric temperature change for a layer. The layer warming/cooling may be given by

$$\frac{\Delta T}{\Delta t} = \left(- \frac{+g}{C_p}\right) \left(\frac{\Delta F}{\Delta p}\right) (1440) \quad , \tag{10}$$

where F is the net irradiance (cal $cm^{-2}min^{-1}$), p is atmospheric pressure (millibars), C_p is the specific heat at constant pressure and 1440 is the number of minutes in a day.

Water vapor inference. The following equations show the technique by which water vapor may be inferred from observed radiance.

The modified equation (1) for downward radiance only is given by

$$N\downarrow = \int_{\nu_1}^{\nu_2} \int_{pr}^{.1} \phi\ (\nu)\ B(\nu, T(p)\ldots)\ \ \frac{\partial\tau(u(p),\nu)}{\partial p}\ dpd\nu \tag{11}$$

where u is the optical mass of water vapor. Here the downward radiance is measured, the filter function is known; a temperature profile above the reference is assumed by using the sounding of the nearest high altitude observing station. The altitude of the reference point (pressure) is known, and finally the frequency band of the radiometer is known, having been selected to be in the water vapor band. Consequently, the only unknown in Eq. (8) is the water vapor optical mass.

Radiance may vary by changing the optical mass since

$$\tau = \tau(w,k) \tag{12}$$

where k is the absorption coefficient for water.

An iterative method is then applied to equation (8) with a different value for u, until the difference between the observed radiance and the newly calculated radiance is minimized. This may be expressed as

$$(N{\downarrow}_o - N{\downarrow}_c) \leq \varepsilon \tag{13}$$

where ε is the noise equivalent radiance of the radiometer.

The optical mass varies with the reference level mixing ratio q_o in the mathematical approximation for u. This may be expressed as

$$u = \frac{1}{g} \int_{P_r}^{P} \bar{q}\, dp \simeq \frac{1}{gp_r} \sum_i q_o p_i^{\lambda} \Delta p. \tag{14}$$

Here g is the acceleration of gravity; the subscript "r" refers to the reference level, and λ is a power law exponent. By carefully choosing the value of λ one may assume a constant mixing ratio or, as experimentally determined, a more realistic profile for the mixing ratio.

Profiling. The method by which the temperature or humidity profile from aircraft may be inferred utilizes the fact that the frequency of the filter or the angle of measurement (x) may be varied, thereby varying the level of the atmosphere from which the radiance measured originates. The upwelling radiance observed by the radiometer is a function of the atmospheric temperature and humidity profiles.

The radiative transfer Eq. (1) may be rewritten as

$$N_r = B(x,p_o)\ \tau(x,p_o) - \int_{p_r}^{p} (x,p)\ \frac{d\tau(x,p)}{dp}\, dp. \tag{15}$$

Here x refers to the frequency or angular characteristics of each observation, (x,p_r) is the atmospheric transmission between the aircraft pressure level (p_r) and pressure p, and p_o is the surface pressure. B(x,p) is the Planck radiance and is given by

$$B(x,p) = C_1\nu^3/[\exp(C_2\nu/T(p)-1] \tag{16}$$

where C_1 and C_2 are Planck constants. $\frac{d\tau(x,p)}{dp}$ in (12) is called the weighting function.

Program RADIANCE uses a direct iterative method to obtain the inverse solution of (12) and (13), and the process is repeated until convergence between the observed and calculated radiance is achieved. This may be expressed as

$$[\Sigma(N(x,p_r)_{calc} - N(x,p_r)_{obs})^2]^{\frac{1}{2}} \leq \varepsilon \tag{17}$$

where ε is the noise equivalent radiance of the radiometer. Rapid convergence is obtained by using a modified Newton-Raphson routine.

2.4 Infrared Radiation Observations and Calculations in the Atmosphere

2.4.1 Background

The SKYLAB field phase in June, August, and September of 1973 in the Houston, White Sands, and Phoenix areas provided a unique opportunity to conduct infrared observations and subsequent calculations of the transmission and absorption properties of haze and middle altitude clouds. The observations used both an 8.0 to 13.0 μm downward looking chopper radiometer and an upward-downward looking radiometer (4.39 to 40 μm) attached to a standard radiosonde.

One aspect of this research was to observe experimentally and analyze a volume absorption coefficient together with related optical properties of dust and middle tropospheric clouds to permit a simple solution for bulk radiation transfer phenomena. Since a detailed, moderately high resolution (1.0 cm^{-1} resolution) radiative transfer approximation program, RADIANCE, has been in use by the authors for several years, and since it being continuously updated, it is only necessary to add these additional absorbers to the existing solution once their radiative character is determined. This in-situ method of determining the haze and cloud optical properties is different from other methods and therefore can provide interesting comparisons.

For the radiometric transfer calculations, the simultaneous radiometersondes provided profiles of the free air temperature and humidity profiles. In each site the measurements were made over nearly homogeneous surfaces in order to provide a nearly uniform interface.

The upwind and downwind locations chosen from some large source such as Phoenix enabled a determination of the IR transmission of both dust and altostratus clouds. In each case, the bases and tops were distinct.

2.4.2 Some IR Radiative Properties of Haze and Clouds

Platt (1973, 1974) as well as Kuhn et al. (1974) and Kuhn (1970) have investigated and reported their results concerning some of the optical properties of cirrus, contrails, and middle altitude clouds. Preceding much of this work were the efforts of Hall (1968) in determining a physical model of radiative transfer in cirrus. The general agreement, at least insofar as the volume absorption coefficient is concerned, is very good. The investigation of middle altitude cloud radiative properties was prompted by a desire to compare these results with previously reported results of Platt (op. cit.) on middle latitude clouds.

The monochromatic emissivity of a haze layer or a cloud layer on the basis of continuity is defined as

$$\varepsilon_\lambda = 1. - \tau_\lambda - \rho_\lambda , \tag{18}$$

where τ is the transmission and ρ the IR reflectivity. From (1) we may write, ignoring ρ,

$$\ln\tau_\lambda = \ln(1-\varepsilon_\lambda) = (-k_\lambda \Delta Z), \tag{19}$$

where K (km^{-1}) is the volume absorption coefficient and ΔZ(km) is the cloud thickness or depth. We now define a bulk absorption coefficient, $K_{\Delta\lambda}$, covering a small spatial interval, $\Delta\lambda$, from 9.5 to 11.5 μm hereafter symbolized as K(Kuhn et al., 1975).

To facilitate comparisons, Table 2 lists the haze and/or cloud physical properties with the symbols employed by the authors on the left and those of Platt (1974) on the right.

Table 2. Physical Properties of Atmospheric Absorbers

This work			Platt
Optical Thickness	:	$\Delta u = \int_{z=0}^{z} K\Delta Z$	$t_A = \int_{h=0}^{h} dh$
Vol. Absorp. Coef.	:	$K(km^{-1})$	$\sigma(km^{-1})$
Cloud Thickness	:	ΔZ(km)	h(km)
Thickness vs. ε	:	$K\Delta Z = \ln(1-\varepsilon)$	$\tau_A = \ln(1-\varepsilon)$

2.4.3 Methods of Analyses

Consider a haze or cloud layer of thickness ΔZ, and optical thickness, $K\Delta Z$, as in figure 1.

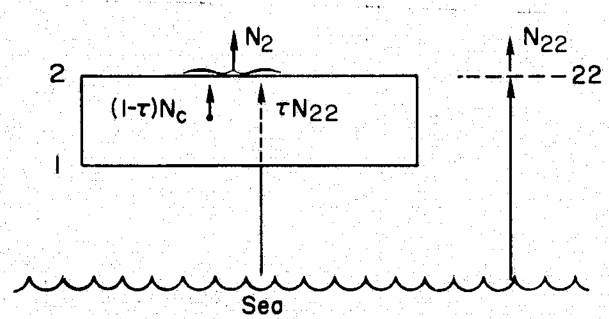

Figure 1. Symbolic atmospheric haze layers with arrows depicting upwelling IR radiance. Here τ represents $\tau_{\Delta\lambda}$ as above in (18).

The radiance transmission $(1-\varepsilon)$ is given by

$$\tau = \frac{N_2\uparrow - N_c\uparrow - \rho(N_2\downarrow - N_c)}{N_{22}\uparrow - N_c\uparrow} \tag{20}$$

and the radiance emissivity is given by

$$\varepsilon = \frac{N_2\uparrow - N_{22}\uparrow - \rho(N_2\downarrow - N_c)}{N_c\uparrow - N_{22}\uparrow} \quad , \tag{21}$$

where τ, ε, ρ, and N all represent parameters over the small wavelength interval, $\Delta\lambda$. Thus we treat a "bulk" τ, ρ, ε and K. The errors in the determination of the absorption coefficient are based on a radiometer noise equivalent radiance of 2.35×10^{-6}w cm^{-2} sr^{-1}. This results in an average error of $\pm$ .05 in the transmission or emissivity, τ and ε, respectively. The error in the volume absorption coefficient from (2) is given by

$$dK = \frac{1}{\Delta Z}\frac{d\tau}{\tau} \quad . \tag{22}$$

From Eq. (22) and from an average error of $\pm$0.05 in transmission, the average error in the volume absorption coefficient, K, is $\pm$.009 km^{-1}. The flux or irradiance emissivity is required in place of the zenith emissivity for radiative flux transfer and IR cooling calculations. Elsasser (1960) shows that the flux emissivity, ε_f, is approximately equal to the zenith emissivity, ε (our observations), of unidirectional radiance from a column of optical depth, $K\Delta Z$, $1.66(K\Delta Z)$.

In these equations $N\uparrow$ is the upwelling radiance (w cm^{-2} sr^{-1}), ρ the layer IR reflectivity, and the subscript "c" is the black body radiance at the mean temperature of the layer. Subscripts 1, 22, and 2 refer to layer levels (Fig. 1). "22" is the same level as "2" but is the upward radiance in a dust-free or cloudless atmosphere. For shallow layers $N_1\uparrow$ may be used in place of $N_{22}\uparrow$ in Eq. (20) with only a small error. However, in deeper layers (>1.5 km) $N_{22}\uparrow$ must be employed. This necessitated a profile in a haze or dust-free area or outside of the cloud.

2.4.4 Results

Haze. Average values of the haze transmission calculated from observations entered in Eq. (20), the volume absorption coefficient, K, and the optical depth, $K\Delta Z$, are summarized in figure 2. These observations through Eq. (19) provide the curve of K. The optical thickness, $K\Delta Z$, is calculated and appears at integer values of the geometric depth of the dust. The mean value of K is 0.042 ± 0.009 km^{-1}. However, the rms deviation is only 0.0035 km^{-1}.

The smooth nature of the transmission and more important of the absorption coefficient suggests a uniform distribution of the atmospheric dust load. Error limits of observations and calculations are given by the

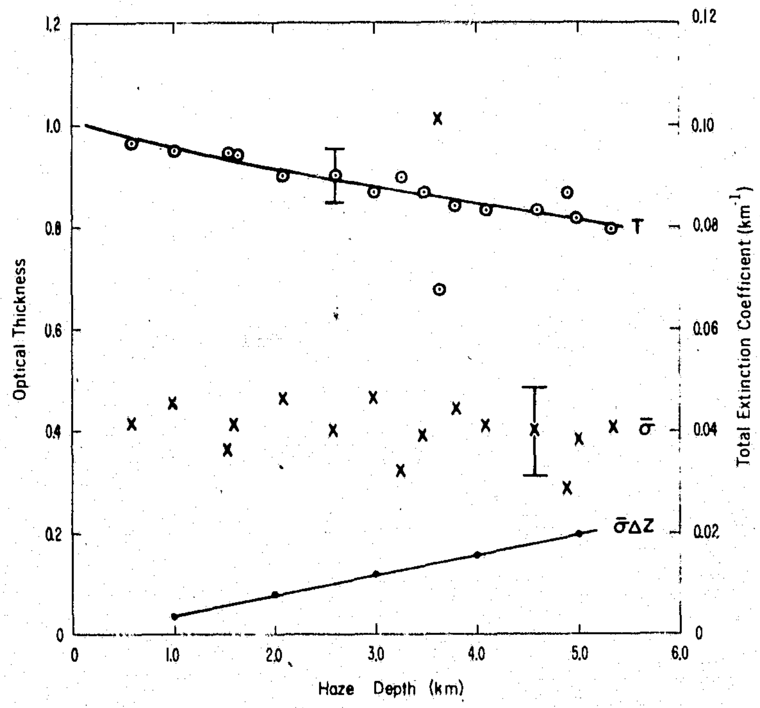

Figure 2. Haze transmission, volume absorption coefficient relative to haze depth and optical depth. Data used are from White Sands, New Mexico, 11 and 12 August 1973.

the vertical arrows. The narrow range of variations in these optical properties is in contrast to the much wider range of variation in clouds. Haze IR properties are an order of magnitude less, numerically, than those of middle clouds. The assumption is further made that the dust particles are uniformly less than a micron in diameter.

Middle Clouds. Table 3 lists the observed and derived optical properties of tropical middle altitude clouds and may be compared with the prior research of Platt (1974). In fact the cloud observations and calculations were made as a result of Platt's excellent work with his lidar.

In the last two sets of As values, the large values of K, the high emission, and the strong absorption indicate that the clouds were composed of large numbers of supercooled water droplets. It is also evident that a mixture of ice crystals and water as well as various particle densities causes the range in the values of K. However, there is a tendency to relate moderately deep, ice crystal clouds with K values <1.0 km^{-1} and shallow dense altostratus, water droplet clouds with K values >7.0 km^{-1}. They are apparently composed mainly of ice particles with some supercooled water droplets evidenced by their lower values of K(K<1.00 km) as suggested by Platt (op. cit.).

Table 3. Observed and Derived Cloud Optical Properties

Cloud Type	Depth (km)	Mean Height (km)	Mean Temp (°C)	τ*	ε_N	K
As-Ac	1.5	6.4	-11.8	0.42	0.58	0.58
As	0.6	6.25	-11.0	0.63	0.37	0.77
As	2.0	6.4	-11.8	0.25	0.75	0.69
As-Ac	2.0	6.2	-10.0	0.23	0.77	0.73
As	0.4	5.7	- 7.0	0.04	0.96	8.06
As	0.3	5.2	- 4.5	0.07	0.93	8.86

*Calculated from Eq. (3) as an average of ten observations of $N_2\uparrow$, $N_{22}\uparrow$ and $N_c\uparrow$.

2.4.5 Calculated Cooling Rates

Atmospheric Haze. The NOAA RADIANCE program discussed in Section 2.3 has provisions for computations involving various aerosol layers such as cloud or haze, providing the volume absorption coefficient is known.

To calculate cooling rates through a haze layer, a temperature/pressure/humidity profile over White Sands, New Mexico, for 11 August 1973 was input to the RADIANCE solution. Figure 3 is a plot of the results, which provide calculated IR cooling rates at the midpoints of each layer in the haze and a corresponding haze-free and cloudless cooling rate profile.

The computations of infrared cooling show the cooling to average only 0.009C hr^{-1} throughout the haze layer. An absorption coefficient of 0.042 km^{-1}, as determined from observations, was used (Fig. 2). This cooling may be easily balanced by solar warming in the layer. This cooling rate would hardly alter the dynamics of the haze layer.

Middle Clouds. Radiometersonde profiles through middle altitude altostratus and altocumulus clouds furnished the RADIANCE calculation input to determine cooling rates through these clouds. Absorption coefficients from Table 2 were employed in two examples with calculated cooling rate curves appearing in figure 4. The curves are labeled, cloudless, K=0.77 and K=0.8. Cloud bases and tops are indicated for the two calculations.

Moderately deep clouds with K<1.00 exhibit calculated cooling rates of up to 0.23C hr^{-1}, not enough to alter the cloud stability. In contrast, shallow dense clouds of water droplets with K ≈ 8.0 display calculated cooling rates of approximately 0.15C hr^{-1}. Such a cooling rate could have an effect on cloud stability.

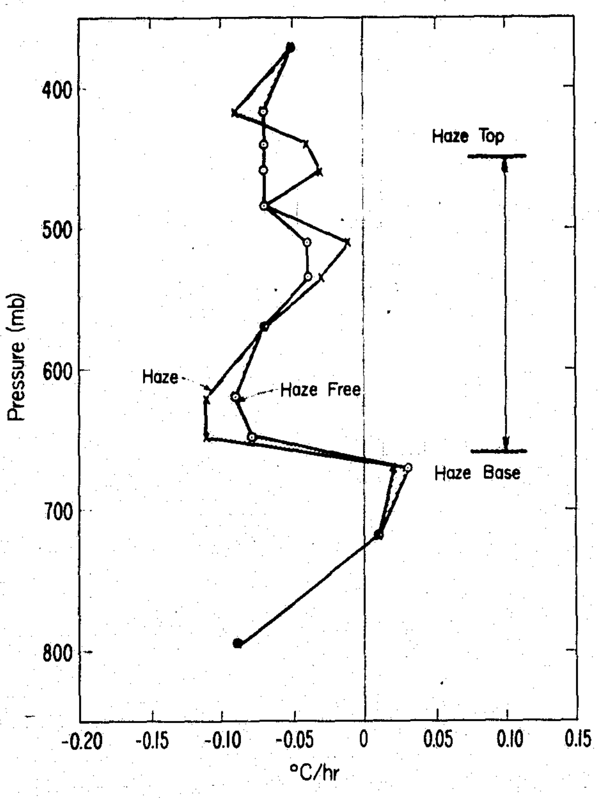

Figure 3. Calculated IR cooling in haze, 11 August 1973, 2130 UT, over sand dunes, White Sands, New Mexico.

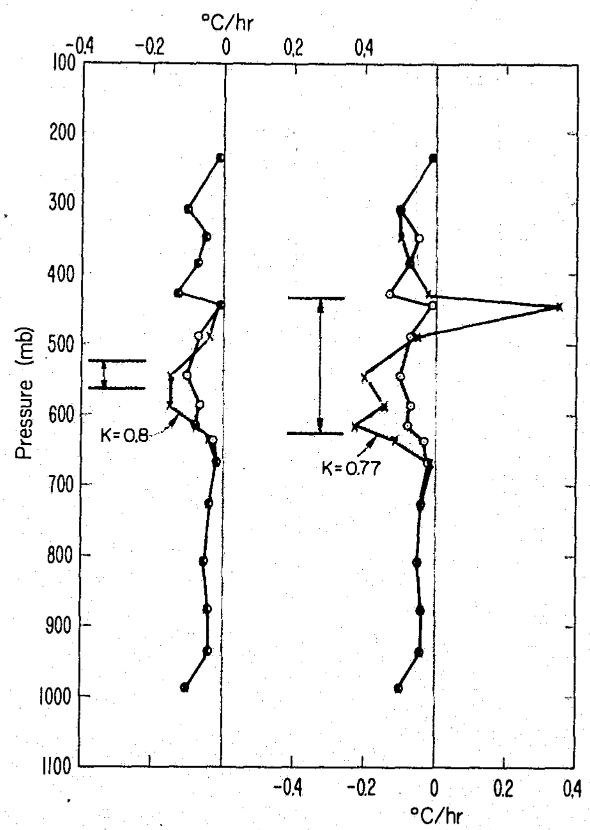

Figure 4. Calculated IR cooling through thin and deep middle clouds, 8 August 1973, 1937 UT over Rosenburg, Texas, oil fields.

2.4.6 Conclusion

It would appear important now to combine IR cooling rates for atmospheric absorbers with solar heating to complete the radiation budget analyses for both cloudless and cloudy and hazy atmospheres. Also the bulk radiative transfer approach employing a volume absorption coefficient determined in the atmosphere for non-gaseous absorbers and combined with a mass absorption coefficient (cm^2g^{-1}) for the gaseous absorbers provides a simple and rapid computer solution. In cloud or in haze, scatter of radiant emission was assumed negligible but the nature of the observations would appear to validate the use of the experimentally determined absorption coefficient in the presence of haze or cloud. A classification of absorption coefficient in relation to various cloud types and depths as well as to various haze or dust layers could now be attempted from the large amount of data available. Further, sufficient simultaneous haze and cloud composition and IR observations exist to attempt this classification as input to radiative transfer calculations for future improved input to numerical weather models.

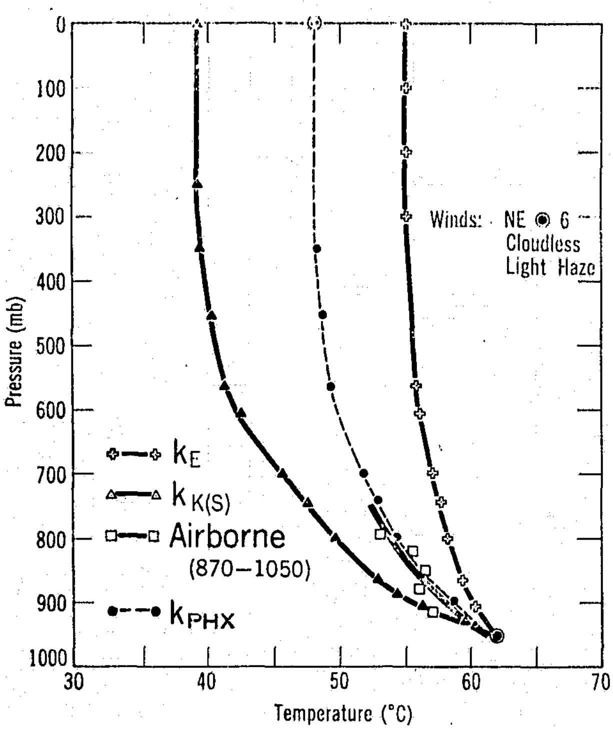

Figure 5. Profiles of surface temperature from helicopter airborne observations, and as calculated with a transfer model, using Elsasser's table (K_E), Smith's table ($K_{K(S)}$), and this study's Phoenix bulk coefficient (K_{PHX}).

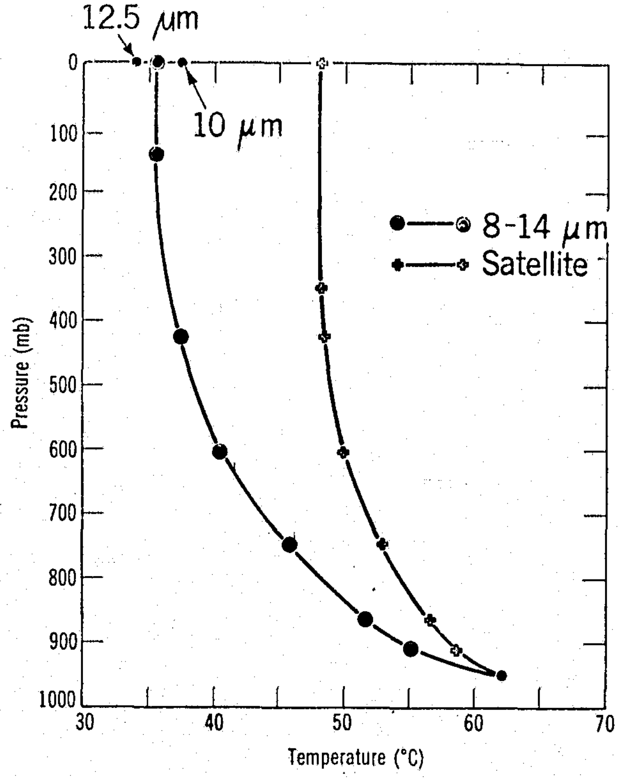

Figure 6. Calculated brightness temperatures.

The special effects of a heavily dust laden atmosphere on the magnitude of the bulk total extinction coefficient for the 11.0 - 11.1 μm spectral interval are evident after a review of figure 5. This figure illustrates calculated and observed brightness (apparent) surface temperatures as a function of height over Rainbow Valley (Phoenix, Arizona). The differences among the calculated and observed profiles clearly demonstrate the necessity of obtaining "K" for a unique area.

Figure 6 illustrates the calculated brightness temperatures at 10.0 and 12.5 μm and at 8 to 14 μm. A computation using 11.0 to 11.1 μm gives a curve close to the satellite curve. It also agrees with calculations made with the Phoenix area determined total extinction coefficient.

Figures 7 and 8 show the sites of the measurements used in figures 5 and 6. Figure 9 summarizes the various bulk total extinction coefficients employed in calculations. K_{TOT} for this paper provides the best results when compared with S-191, 11.0 - 11.1 μm channel. Note that ν(cm^{-1}) is the inverse of the wavelength in microns.

Figure 7. SKYLAB photomap of Phoenix, Arizona, area.

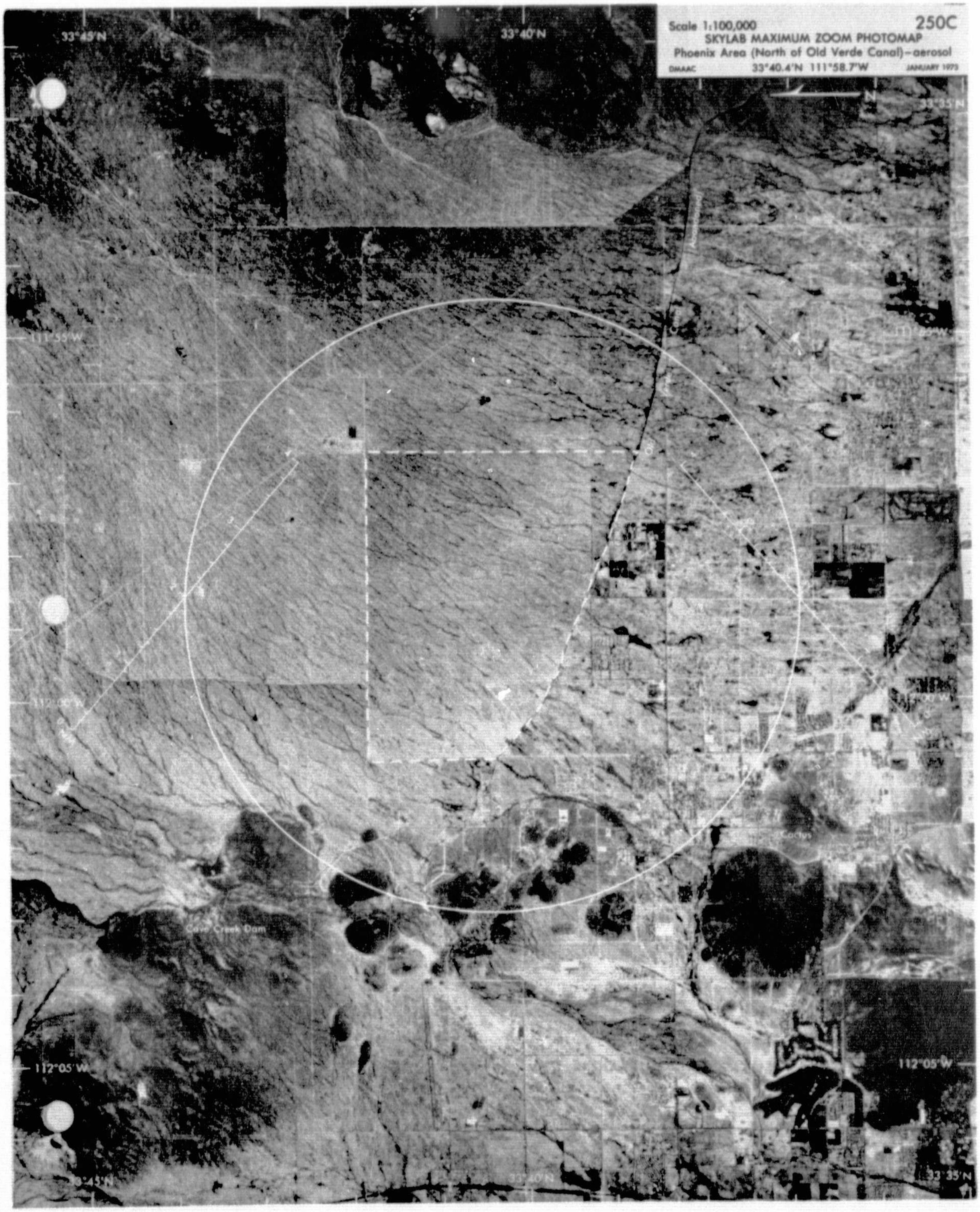

Figure 8. SKYLAB photomap of Phoenix area north of Old Verde Canal.

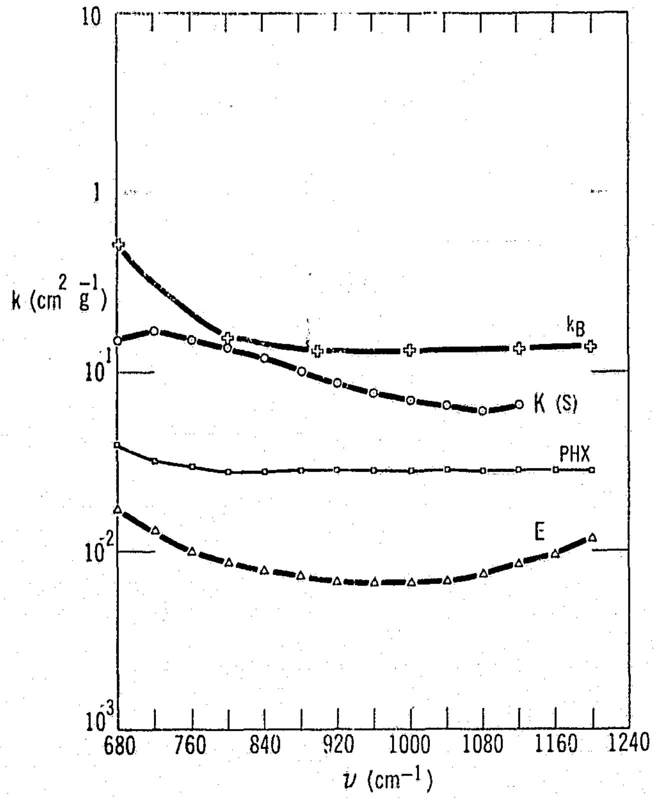

Figure 9. Total extinction coefficients (cm^2g^{-1}) according to Bignell (K_B), Kuhn utilizing Smith CO_2 tables (K(S)), Kuhn utilizing Elsasser CO_2 tables (E), and this study (PHX).

2.5 Absorption of Tropospheric Aerosols: Urban and Rural Aerosols of Phoenix, Arizona

The infrared optical properties of aerosols around Phoenix, Arizona, were studied to evaluate the effects of the interaction of atmospheric particulate matter with long wave radiation. This was accomplished by collecting aerosols on membrane filters at 500 m msl that had air asperated through them at a controlled rate. A Gardener fine particle counter was run concurrently. Filter samples were then analyzed for particle sizes by a scanning electronic microscope. The aerosol absorption coefficient was calculated according to Mie theory. By measuring the aerosol layer transmission, the bulk total extinction coefficient was determined. Further calculations show that at 10 μm wavelength, more than 95 percent of the infrared extinction is caused by absorption. The imaginary part of the infrared refractive index of 0.47 for urban and 0.19 for rural aerosols was calculated by Pueschel and Kuhn (1975).

2.6 Discussion and Conclusions of the Surface and Boundary Layer Experiment

This field program, under EREP SKYLAB overpasses of selected sites, was designed to achieve three primary objectives:

1. Provide in-situ balloon-borne radiometersonde observations of total (infrared plus solar) upward and downward irradiance (flux) from the surface to 35 km for comparison with and verifications of selected atmospheric radiative transfer models. These results were correlated with the S-191 broad-band data.

2. Determine the mass absorption coefficient (cm^2g^{-1}) in the atmospheric window (8.0 to 14.0 μm, 714 to 1250 cm^{-1}) by direct relating of S-191 11.0 to 11.1 μm (900 to 910 cm^{-1}) brightness temperature observations to surface and helicopter radiometric observations in the same spectral band.

3. Provide interface (air-surface) observations of net total radiation, net total insolation reflected insolation, downward insolation and albedo for calibration, ground baseline, and comparison with S-191, S-192, airborne, and balloon-borne radiometric observations.

Conclusions relative to the first objective were that the balloon radiometersonde, a device flown successfully since 1957, does provide a comparison for radiative transfer models that is at least as accurate as the models. Deviations of radiative flux and intensity calculations are due to inadequate knowledge of real atmosphere transmission. The SKYLAB S-191 radiometer was vital in providing correlative atmospheric long wave intensities (radiance) in the center of the atmospheric window region.

Relative to the second objective, it was possible to determine the mass absorption coefficient of the atmosphere over at least the Phoenix site in the 8 to 14.0 μm (714 to 1250 cm^{-1}) spectral band and in the 11.0 to 11.1 μm (900 to 910 cm^{-1}) spectral band by combining observed S-191 brightness (radiance) temperatures with balloon radiometric and helicopter radiometer data. This results from in-situ field observations requiring the S-191 observations is important in that it provides parameters required for proper atmospheric radiative transfer under a typical desert southwest atmosphere under summer conditions.

The third objective, that of providing ground baseline observations for S-191 and S-192, basically a data-base effort, was also achieved.

3. AIRCRAFT EXPERIMENT

3.1 Comparison of Models For Computing Atmospheric Infrared Transmission

Various models were used in describing the primary differences in transmissiveness of gaseous constituents of the atmosphere. Among them were RADIANV of Colorado State University and RADIANCE of the NOAA, Environmental Research Laboratories. These include options for computing

radaiation transmission including ozone, aerosol, and continuum as well as water vapor and carbon dioxide transmissions.

These models were then compared with SKYLAB infrared spectrometer data. It was shown that all models are capable of computing atmospheric absorption and emission from the earth's surface to within 5 percent accuracy. The models are described in detail in Renne and Marlatt, 1975.

3.2 Spectral Estimates of Albedo and Comparison to SKYLAB Observations

An application of the "adding" or "doubling" method has been made for homogeneous atmospheric layers composing an inhomogeneous atmosphere (Rainey and Marlatt, 1975). The lower layer was assumed to be composed of silicate particles of complex refraction index 1.55 - 0i corresponding to a wave length of 0.5 μm. The particle size distribution was measured on site. The upper layer was assumed to be a gaseous layer scattering light in accordance with Rayleigh's phase function. Radiance values were computed for a planetary system composed of the described atmospheric layer overlying a Lambert reflecting ground. These values show a fairly good agreement with the SKYLAB observations given a reasonable knowledge of the scattering (or reflecting) properties of the atmosphere and ground.

3.3 Conclusions

This field program at aircraft level was designed to determine the accuracy and applicability of a number of radiative transfer models for the atmosphere by comparing values from the models in conjunction with observations from the SKYLAB spacecraft, from balloon radiometersondes, and from surface radiometers.

Note that the transfer models studied covered, basically, the same frequencies of the spectrum as were employed in the S-191 and S-192 SKYLAB radiometers. In fact the 11.0 to 11.1 μm (900 - 910 cm^{-1}) band of S-191 was basic to transfer calculations in this atmospheric window region, providing interface brightness (apparent) and physical temperatures. The S-192 data provided the areal background imagery for verification.

The results of this study were: (1) Each of the models tested was able to compute the long wave radiation emitted from the earth's surface to an accuracy of 5 percent of observed radiance. (2) The models were all most sensitive to input parameters, especially surface temperature, water vapor and ozone. (3) Particularly in dry atmospheres, all models tended to overestimate the opacity of the atmosphere in the 8-14 μm bandpass.

4. DISCUSSION AND CONCLUSIONS DERIVED FROM SCARP

The SKYLAB Concentrated Atmospheric Radiation Project succeeded in utilizing radiometric observations from the SKYLAB Earth Resources Experiment Package. Its primary goal was to arrive at a more complete description

and model of radiation transfer within the atmosphere by employing in-situ satellite, aircraft, ground, and balloon-borne radiometric observations. Specifically an attempt was made to determine the applicability of a variety of radiative transfer calculation models computing radiative flux in air masses of different character, i.e., varying amounts of wet and dry aerosol burden, varying interface types, and varying temperature and humidity profiles.

The method of comparison was one of obtaining in-situ SKYLAB S-191 and S-192 observations, aircraft and balloon-borne profiles of upwelling and downwelling radiance and irradiance, and ground-base observations of net and total infrared and solar radiation. Having temperature and humidity sounding profiles under the EREP overpasses, we ran the transfer calculations in both the solar and infrared spectra and compared them with the in-situ observations. The field data for comparisons were good and these data sets are available for further research, either as computer plotted graphs in this report or as card and/or tape data sets. Printer output is also readily available. From this basic effort one may conclude that, direct observations are superior to present transfer calculations, and this is because of a lack of knowledge of complex atmospheric transmission.

This comparison of several existing infrared radiative transfer models under somewhat controlled conditions and with the above atmosphere observations of SKYLAB's S-191 and S-192 radiometers illustrated that the models tend to over-compute atmospheric attentuation in the window region of the atmospheric infrared spectra. Add to this the variability of radiance calculations from the different models, all with identical input data, and one is led to the conclusion that much further research on in-situ atmospheric transmission observations and calculations is a necessity. This is further evidenced by inaccuracies in satellite temperature and humidity profile specifications from an inverse solution to the transfer equation. In this connection atmospheric transmission functions for at least the Phoenix summer atmosphere appear to have been determined.

A basic recommendation for future studies would be to employ the SCARP accumulated satellite, aircraft, and balloon platform acquired data in an attempt to determine atmospheric, broad-band transmission coefficients for the Phoenix and Houston areas. This could be accomplished from the data set on hand and could serve the radiative transfer modeling community well. Such an undertaking could be undertaken for little more than computer costs and some salary budgeting.

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APPENDIX A

Plots of Observed Radiation Flux Profiles
During SKYLAB

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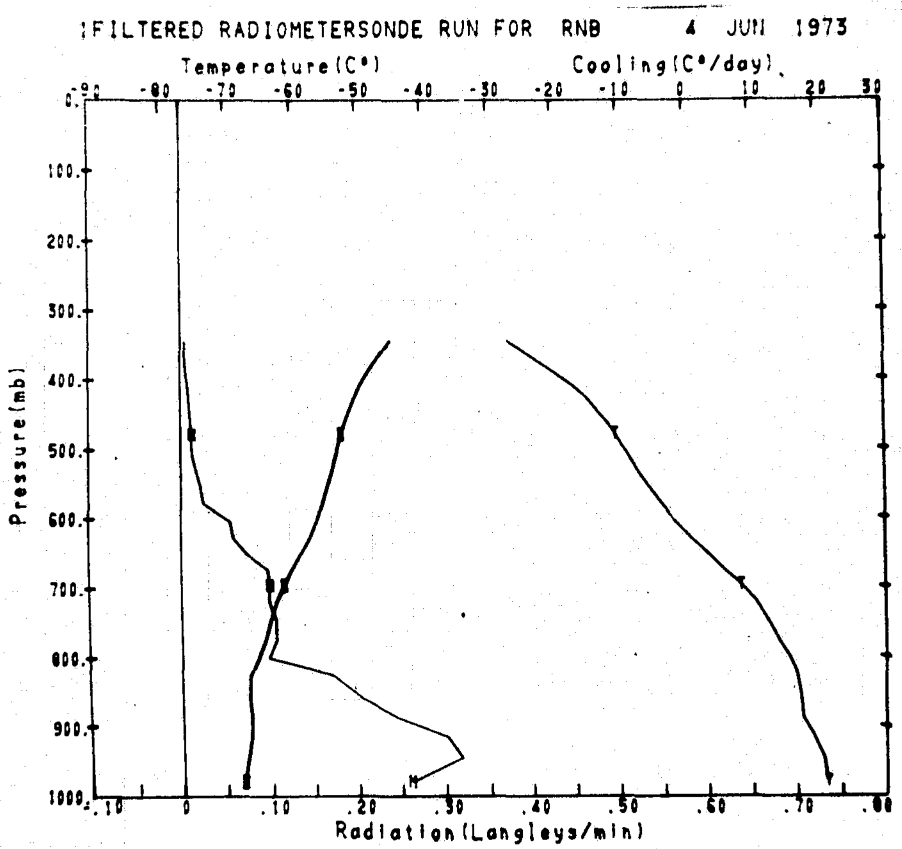
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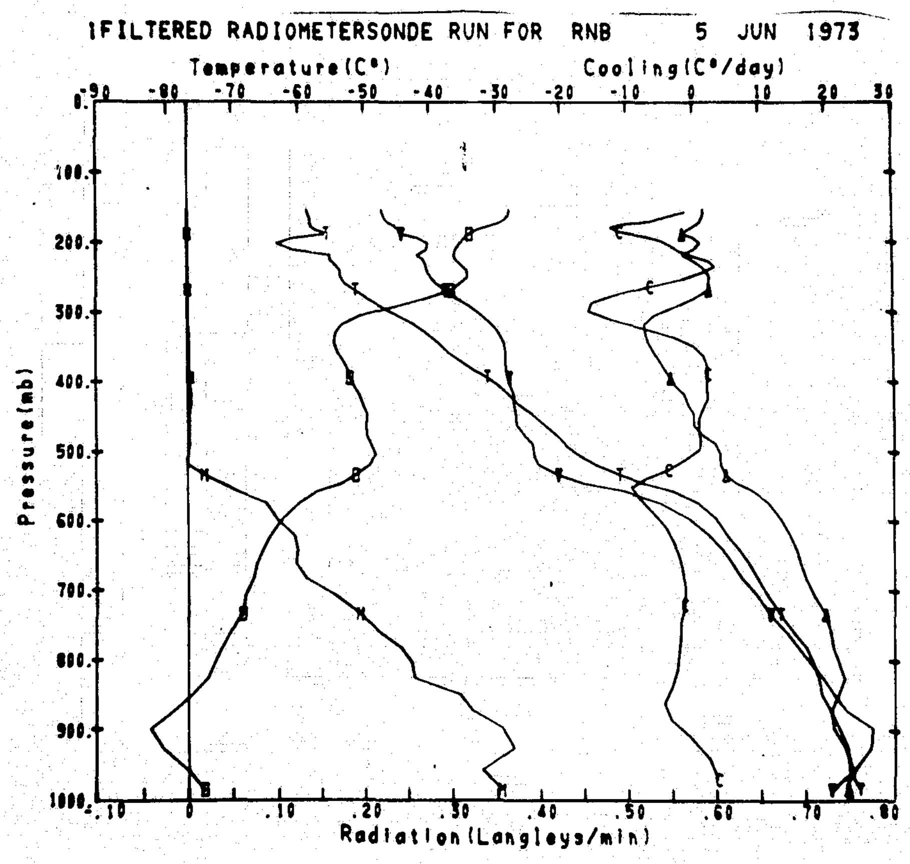
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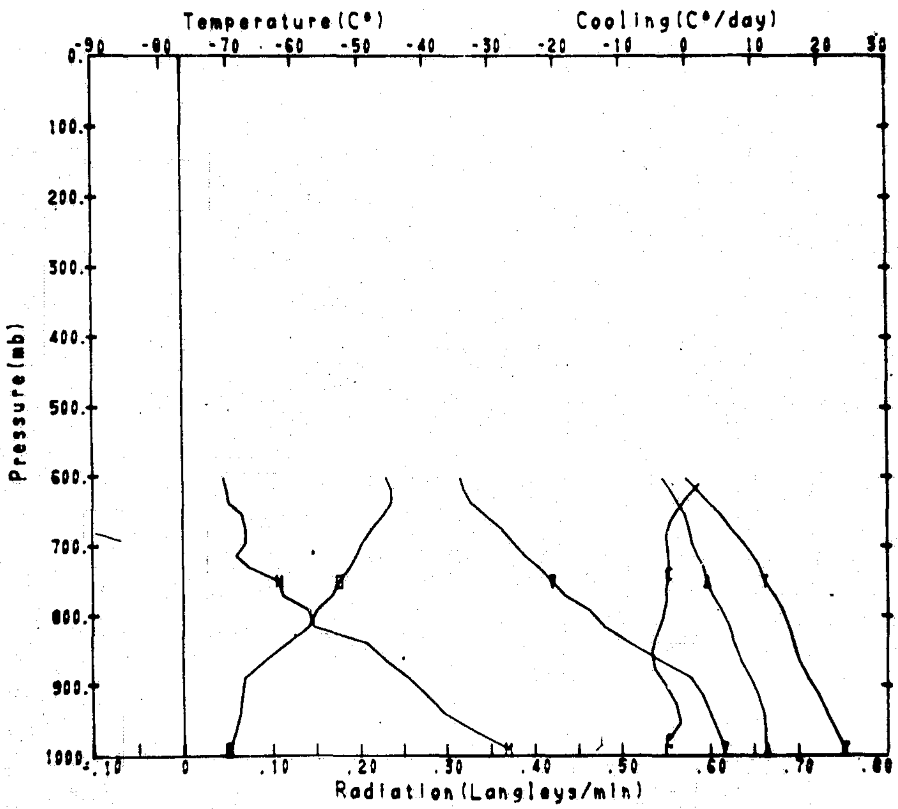

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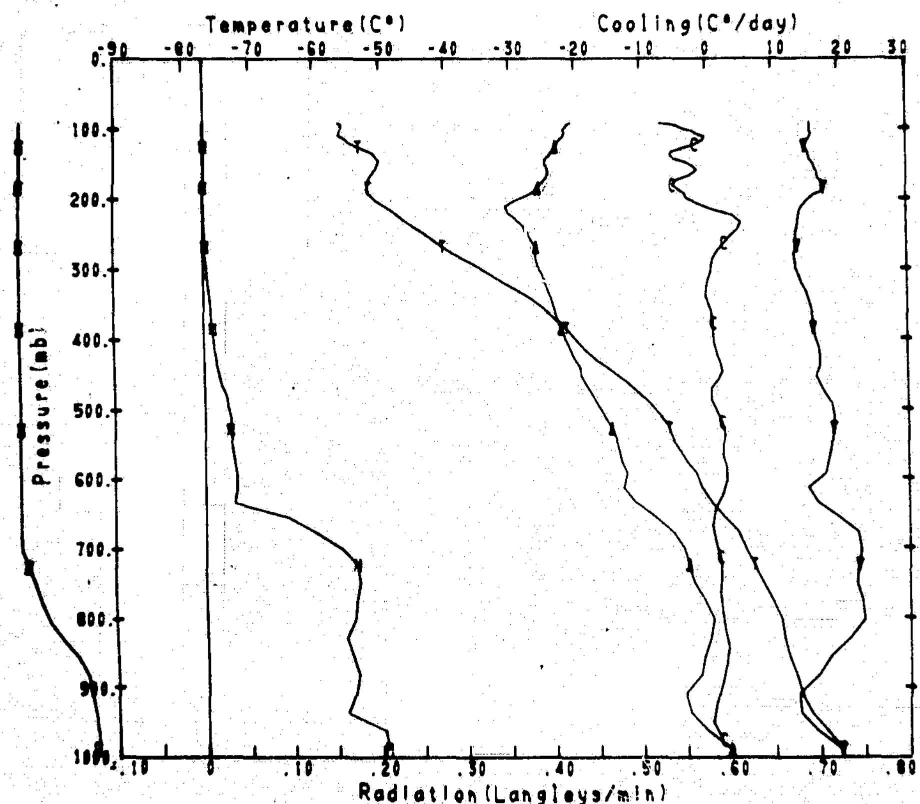

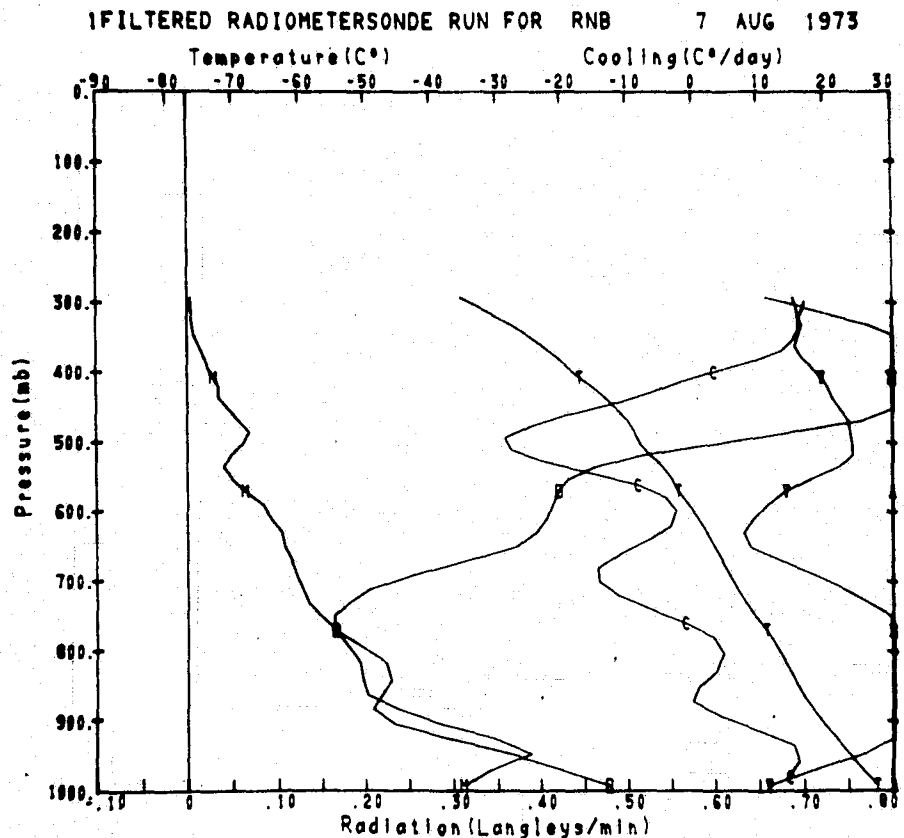
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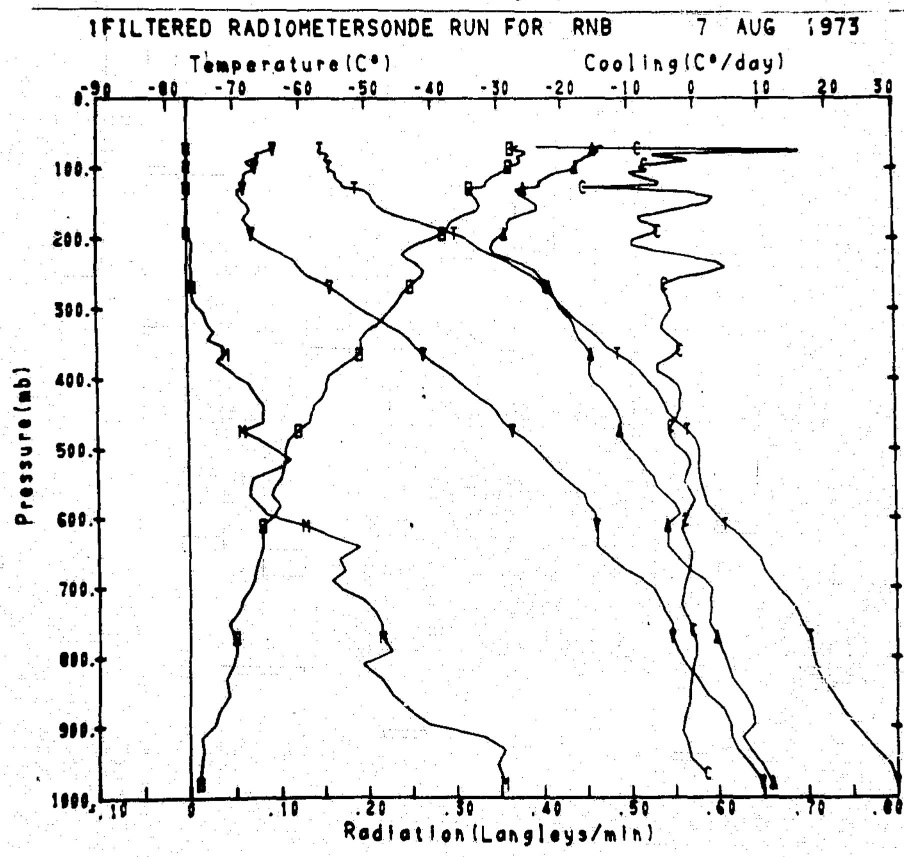
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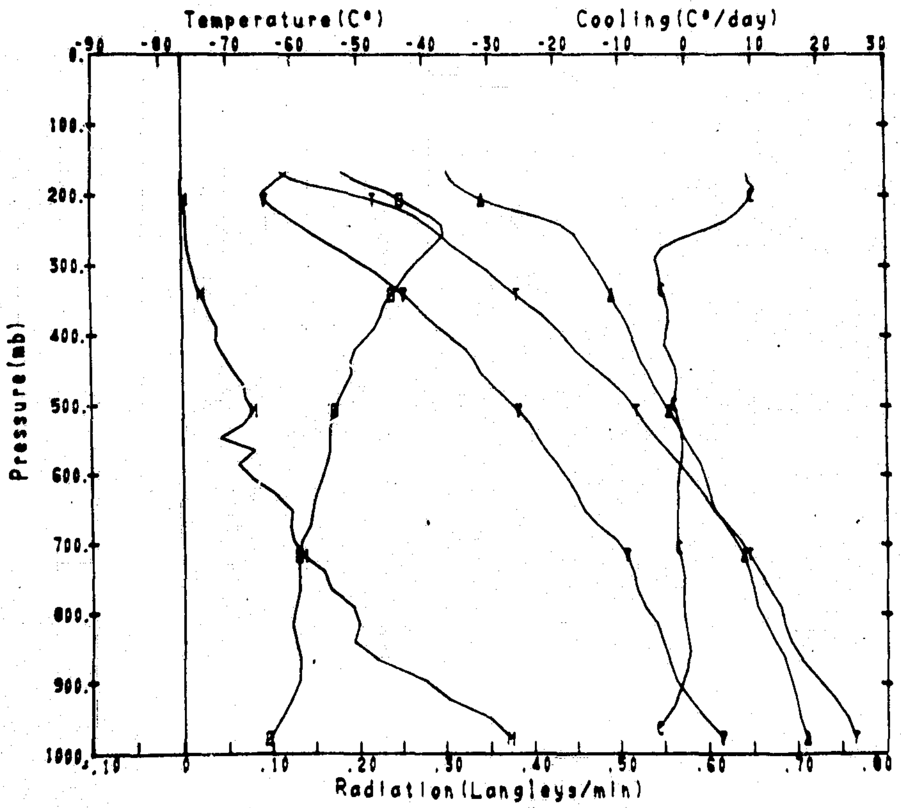

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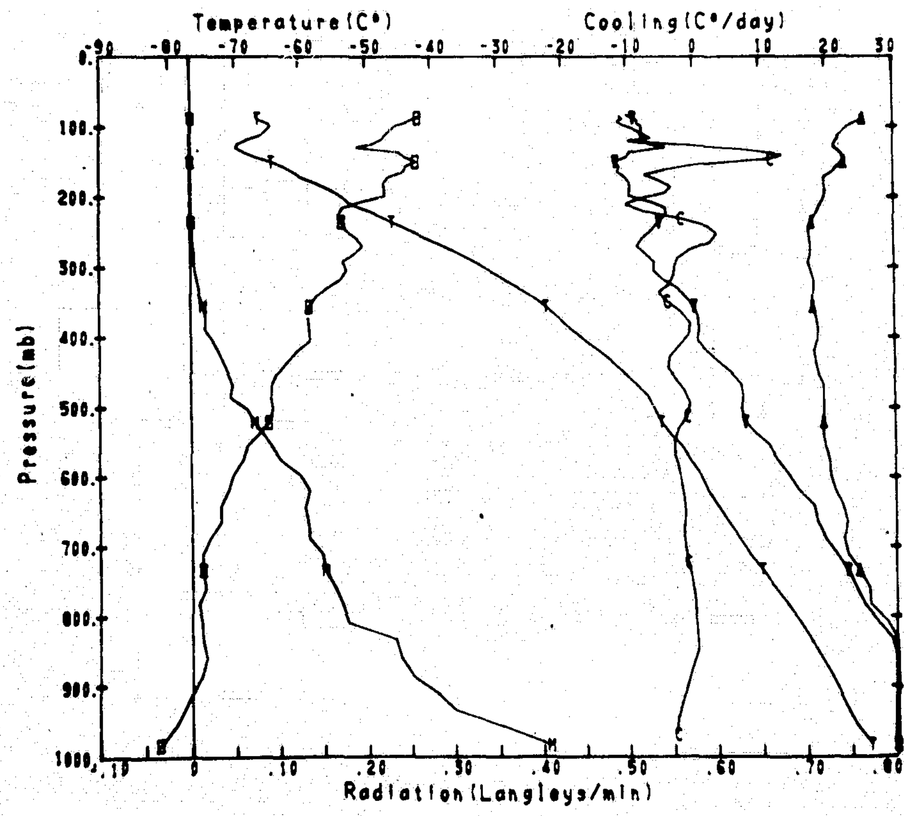

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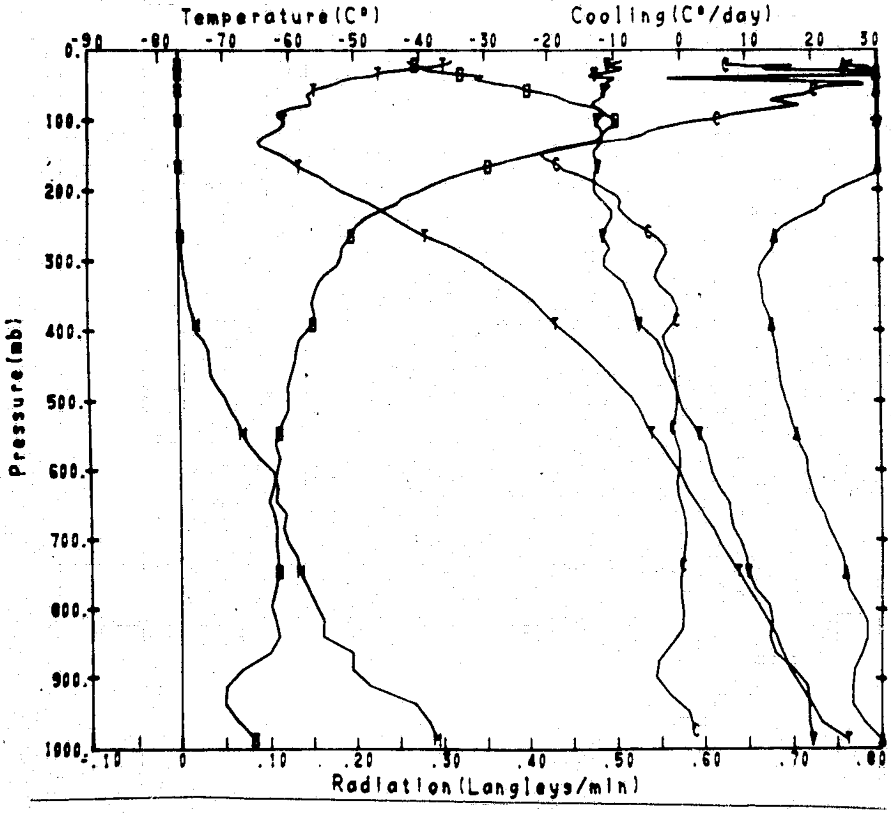

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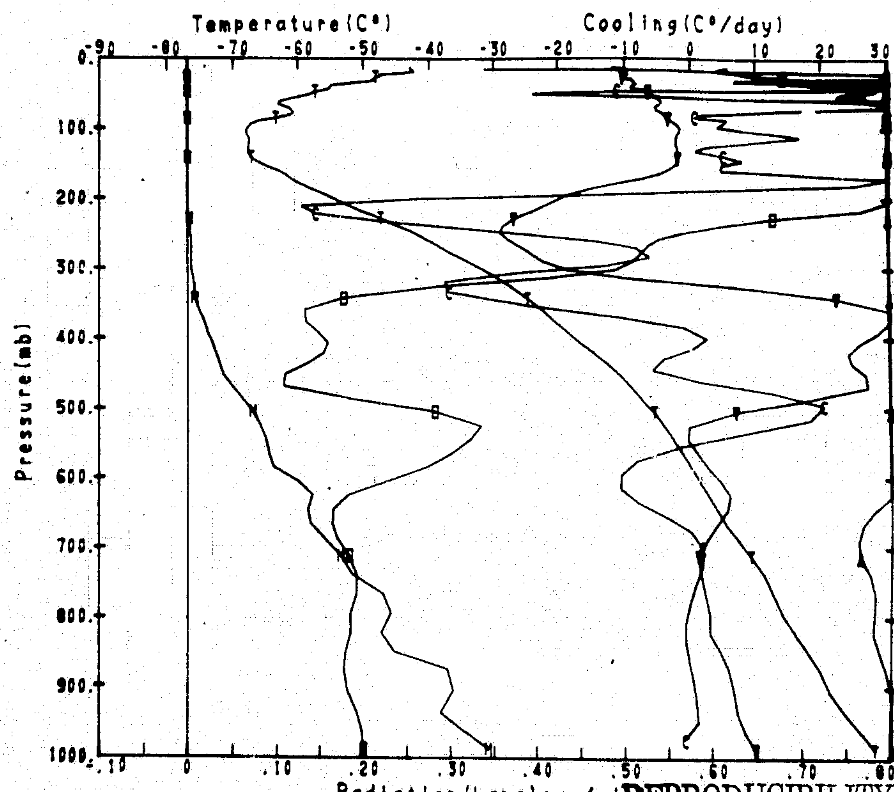

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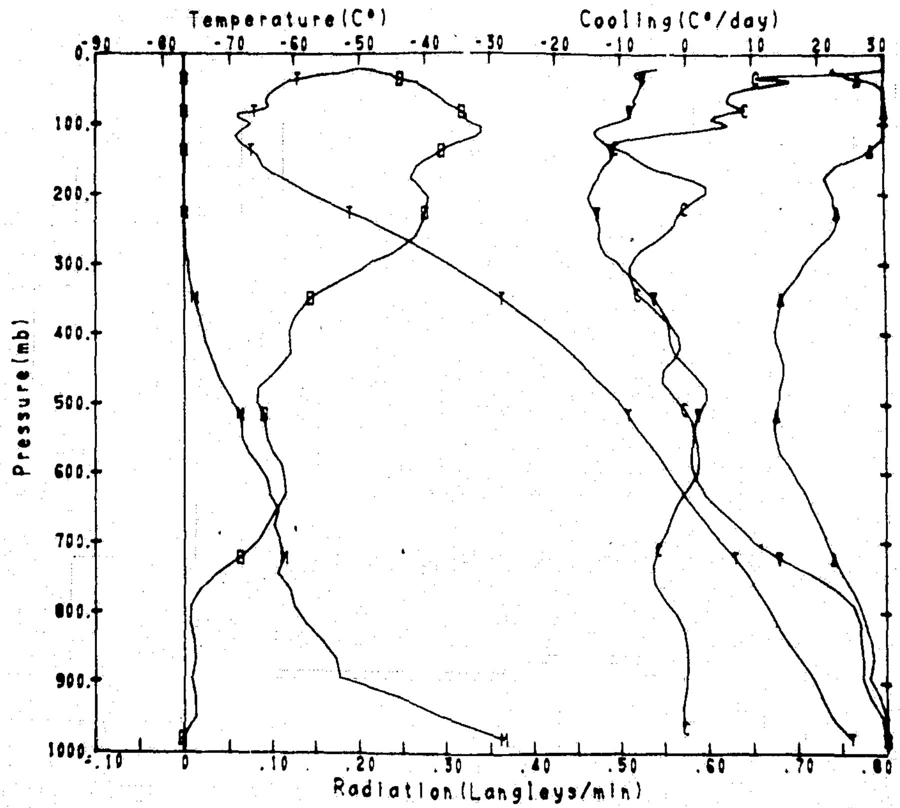

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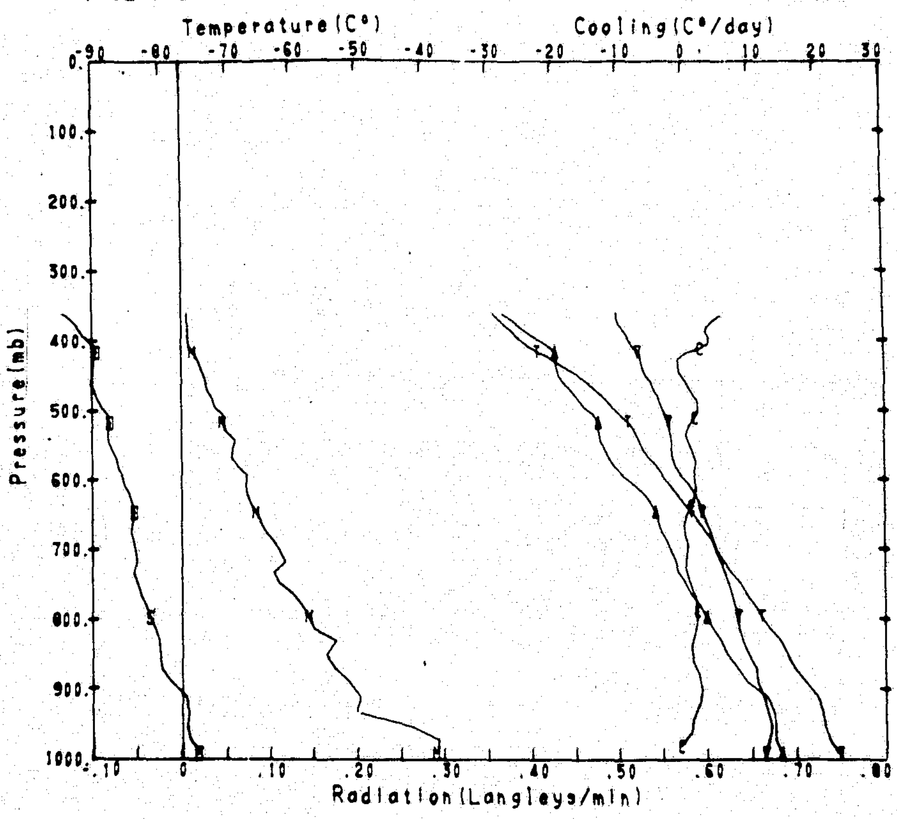

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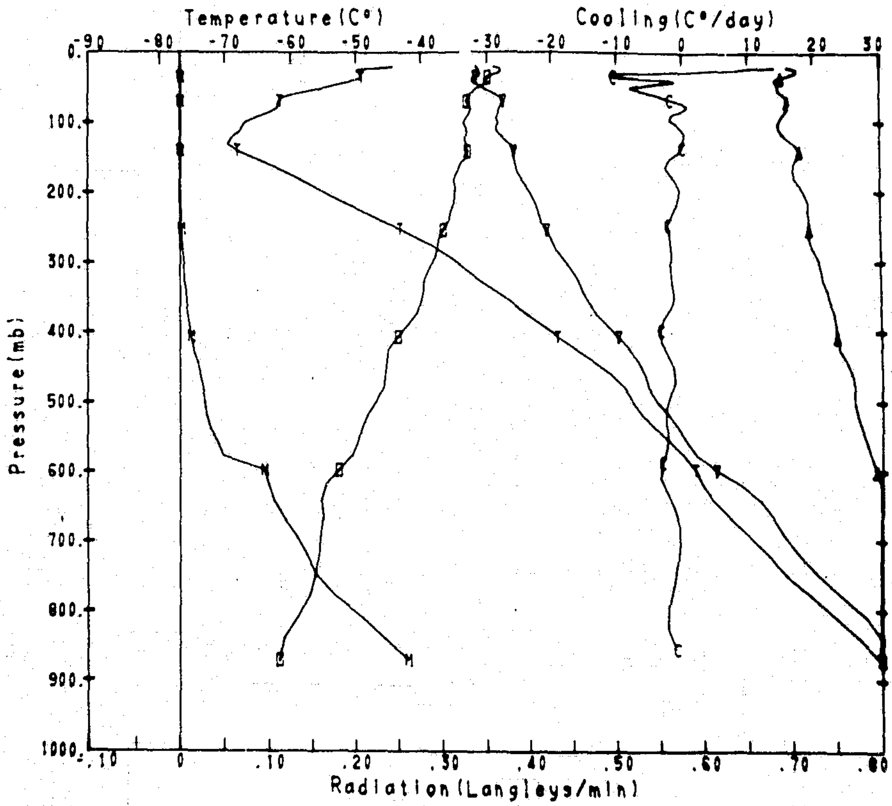

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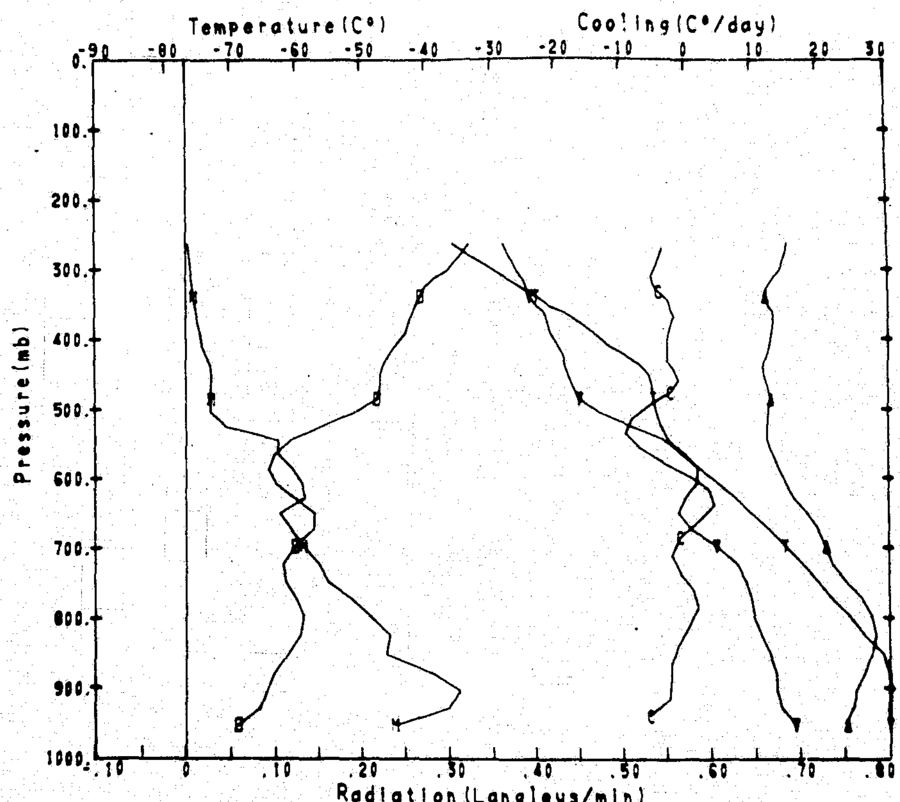

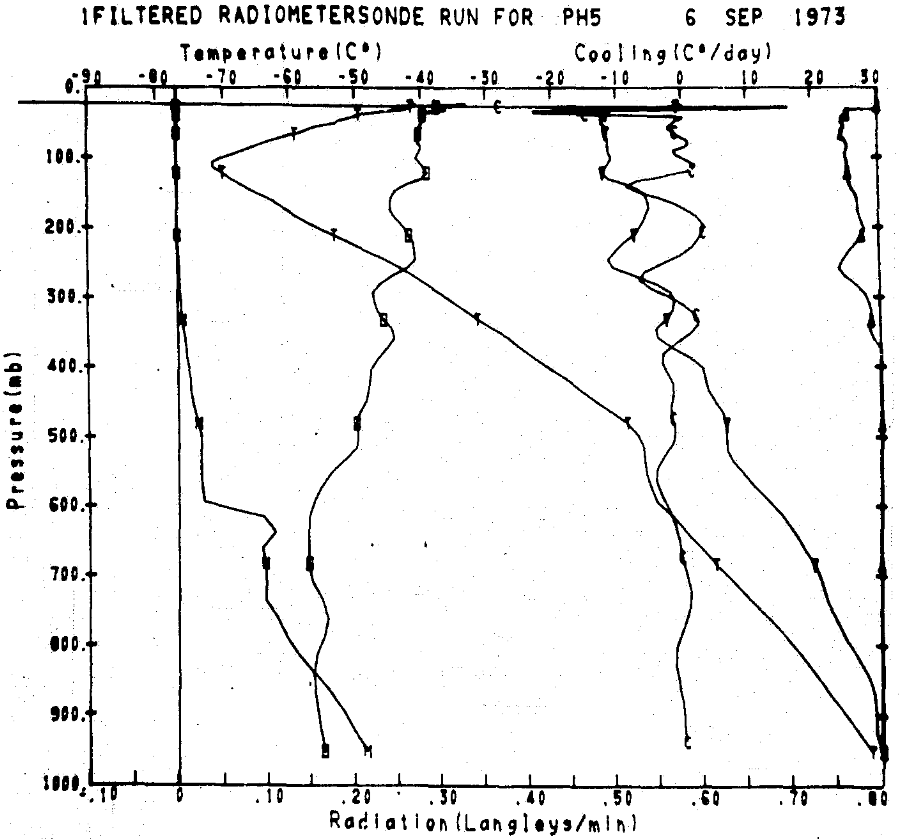
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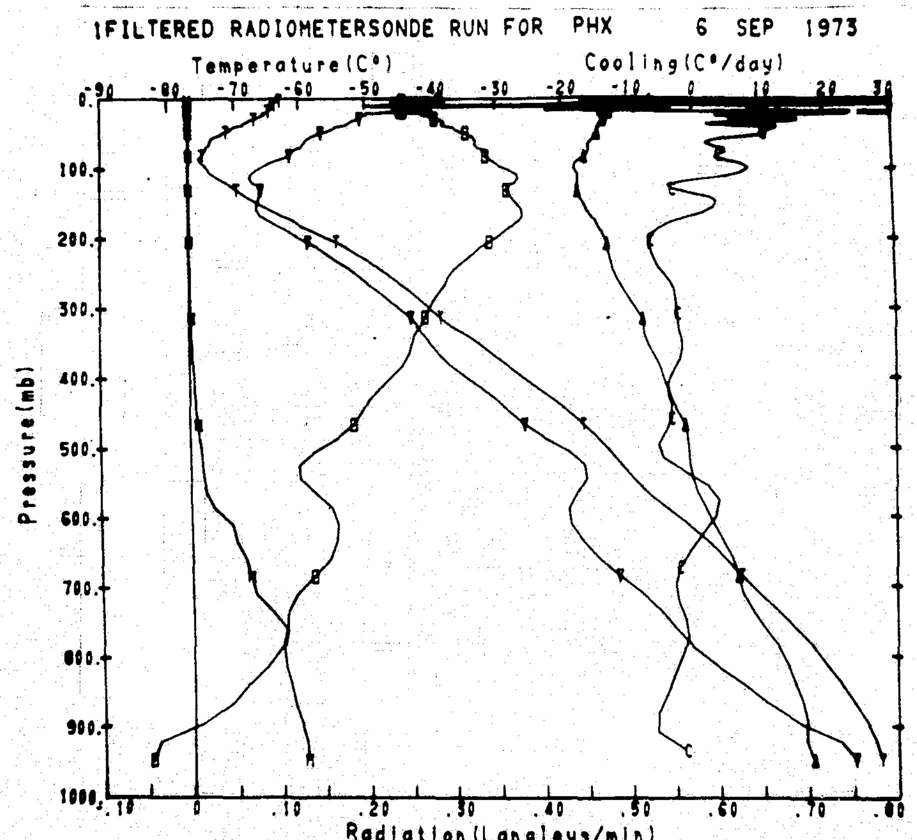
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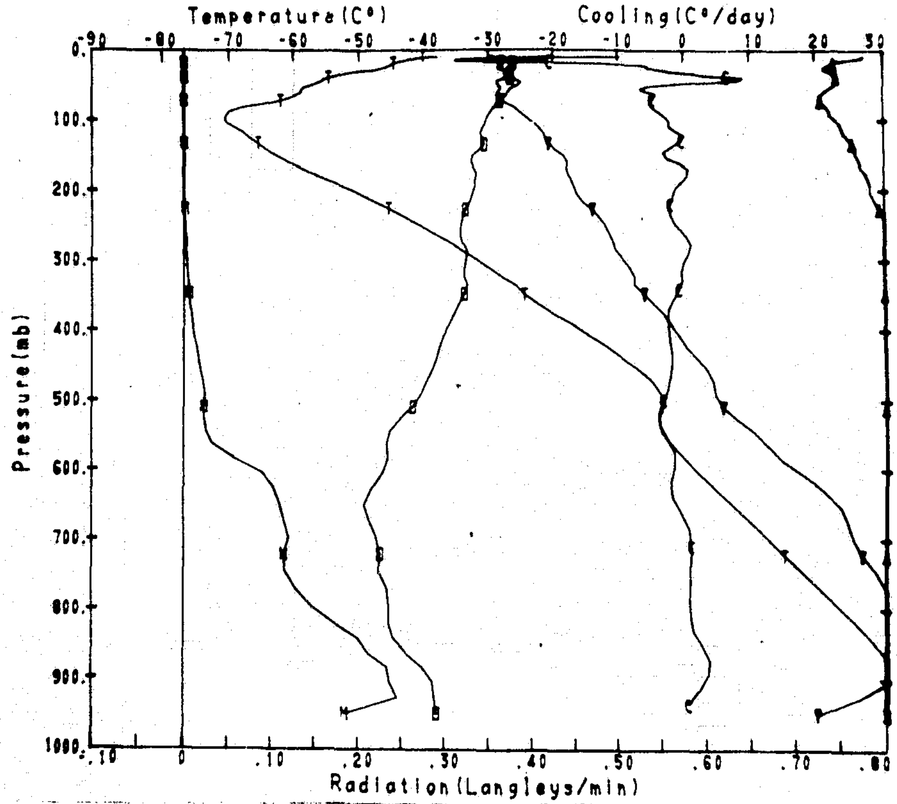

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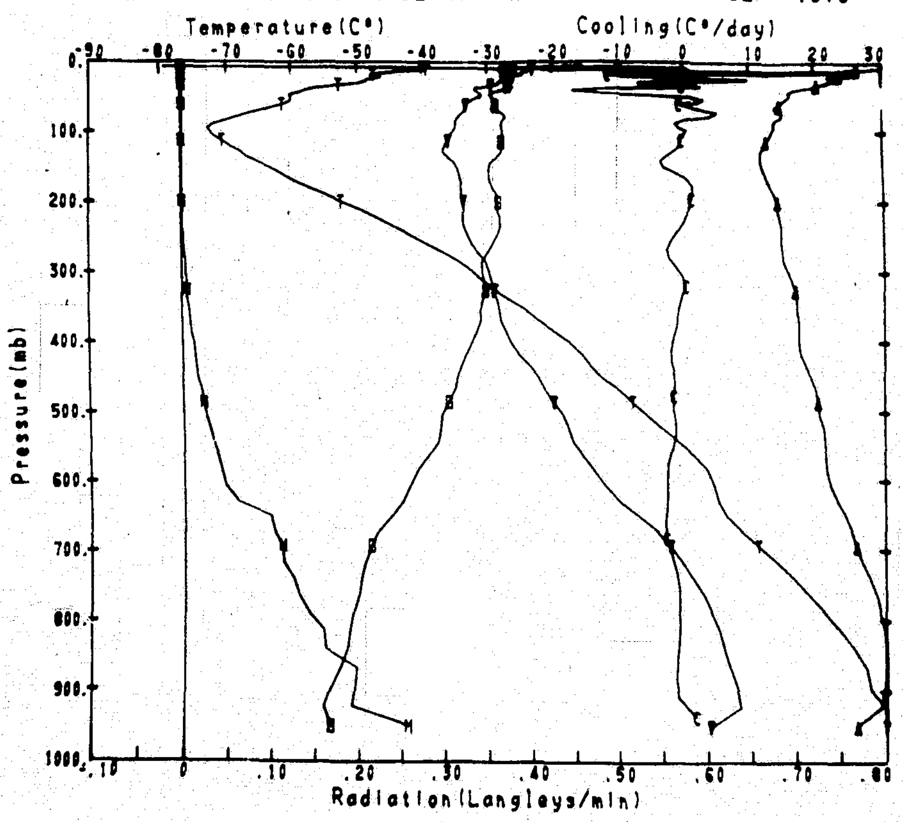

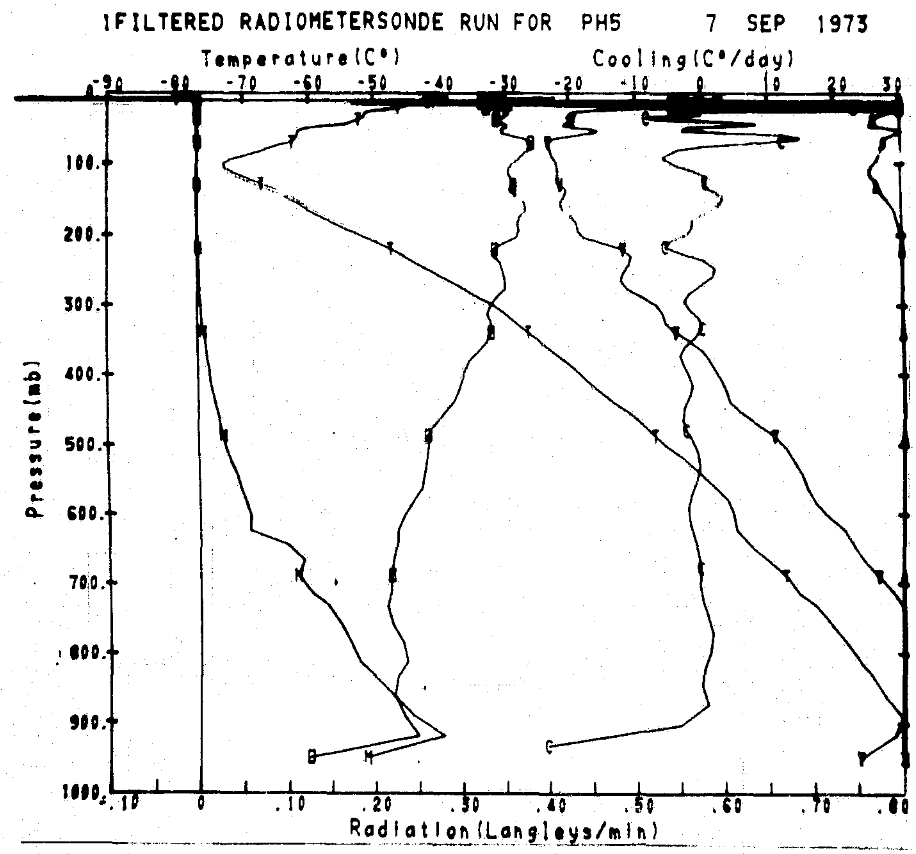

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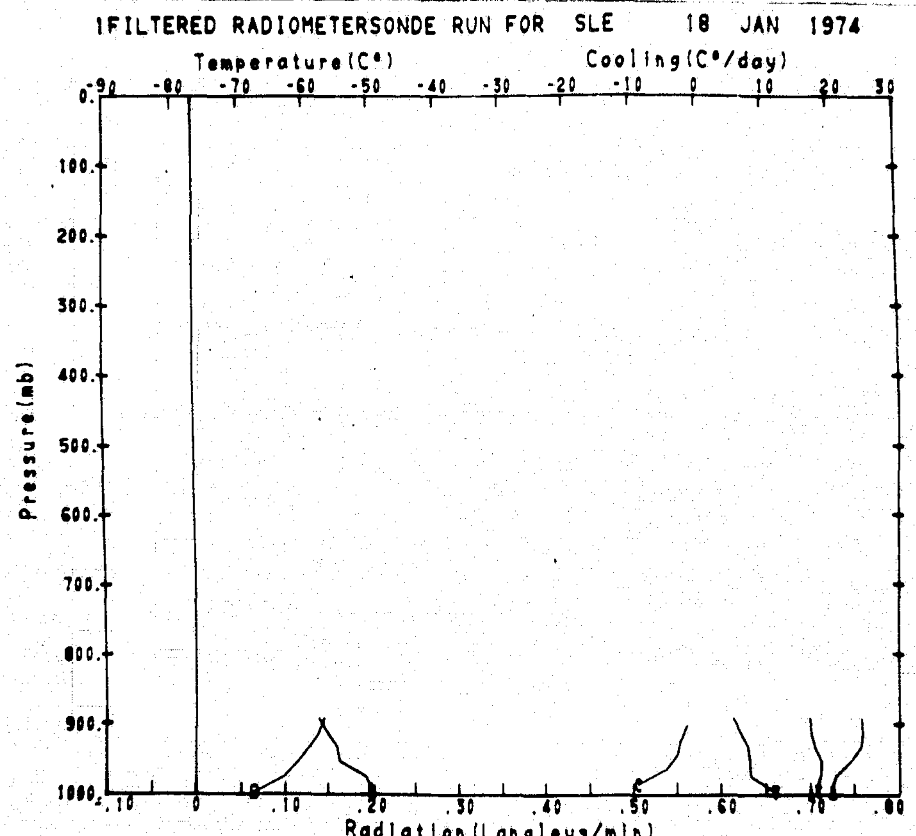

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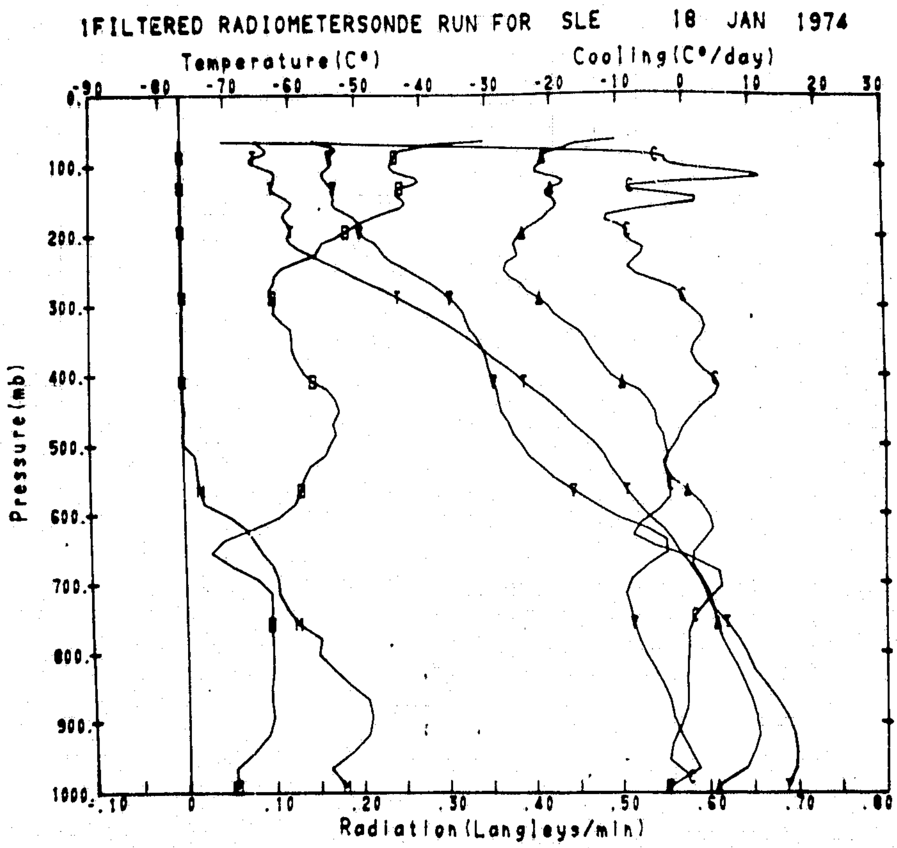
Pressure(mb)
Radiation(Langleys/min)



1FILTERED RADIOMETERSONDE RUN FOR SLE 18 JAN 1974
Temperature(C°)
Cooling(C°/day)
-90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30
Pressure(mb)
0. 100. 200. 300. 400. 500. 600. 700. 800. 900. 1000.
-.10 0 .10 .20 .30 .40 .50 .60 .70 .80
Radiation(Langleys/min)

APPENDIX B

Data Listings of Observed Radiation Profiles
During SKYLAB

1FILTERED RADIOMETERSONDE RUN FOR RNB 4 JUN 1973 OPUS 1

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1017.1	0.0	20.8	0.0548	0.0548	0.0000	0.0	11.910	77
980.3	1.0	21.3	0.0638	0.0638	0.0000	0.0	13.036	81
946.5	2.0	20.8	0.0724	0.0724	0.0000	0.0	15.843	92
915.6	3.0	19.3	0.0766	0.0766	0.0000	0.0	15.024	99
887.9	4.0	17.6	0.0772	0.0772	0.0000	0.0	12.170	85
858.5	5.0	17.3	0.0756	0.0756	0.0000	0.0	10.083	70
828.0	6.0	16.9	0.0771	0.0771	0.0000	0.0	8.523	57
802.3	7.0	15.7	0.0857	0.0857	0.0000	0.0	4.823	35
776.2	8.0	14.0	0.0928	0.0928	0.0000	0.0	5.247	40
748.2	9.0	12.4	0.0993	0.0993	0.0000	0.0	5.248	43
720.1	10.0	10.6	0.1060	0.1060	0.0000	0.0	4.980	43
697.5	11.0	8.3	0.1145	0.1145	0.0000	0.0	4.926	49
675.1	12.0	5.8	0.1240	0.1240	0.0000	0.0	4.807	57
652.0	13.0	3.3	0.1342	0.1342	0.0000	0.0	3.680	49
629.3	14.0	0.7	0.1446	0.1446	0.0000	0.0	2.337	46
605.2	15.0	-1.7	0.1532	0.1532	0.0000	0.0	2.825	51
579.1	16.0	-3.8	0.1600	0.1600	0.0000	0.0	1.273	25
553.9	17.0	-5.6	0.1657	0.1657	0.0000	0.0	1.140	25
530.8	18.0	-7.3	0.1711	0.1711	0.0000	0.0	0.889	21
511.3	19.0	-8.5	0.1757	0.1757	0.0000	0.0	0.697	17
494.4	20.0	-9.6	0.1786	0.1786	0.0000	0.0	0.655	18
480.3	21.0	-10.5	0.1813	0.1813	0.0000	0.0	0.638	18
464.4	22.0	-11.7	0.1860	0.1860	0.0000	0.0	0.605	18
447.6	23.0	-13.1	0.1908	0.1908	0.0000	0.0	0.551	18
429.5	24.0	-14.7	0.1966	0.1966	0.0000	0.0	0.521	18
411.1	25.0	-16.8	0.2038	0.2038	0.0000	0.0	0.452	18
393.5	26.0	-19.5	0.2127	0.2127	0.0000	0.0	0.383	18
377.6	27.0	-22.0	0.2215	0.2215	0.0000	0.0	0.332	19
361.7	28.0	-24.5	0.2302	0.2302	0.0000	0.0	0.287	20
346.2	29.0	-27.0	0.2388	0.2388	0.0000	0.0	0.242	20

1FILTERED RADIOMETERSONDE RUN FOR RNB 5 JUN 1973 OPUS 3

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1011.5	0.0	25.0	0.6654	0.6529	0.0125	0.0	19.501	98
992.1	0.8	23.8	0.6652	0.6163	0.0489	-11.0	18.490	97
967.0	1.8	22.4	0.6643	0.6084	0.0559	-3.0	16.616	93
940.2	2.8	21.0	0.6617	0.5995	0.0622	-1.1	14.845	89
914.1	3.8	19.7	0.6553	0.5905	0.0649	-1.8	13.746	86
888.8	4.8	18.2	0.6463	0.5782	0.0681	-3.3	12.725	85
864.3	5.8	16.8	0.6356	0.5443	0.0913	-4.9	11.467	83
839.1	6.8	16.0	0.6277	0.5089	0.1189	-5.3	10.352	75
815.5	7.8	15.3	0.6221	0.4796	0.1426	-4.7	7.360	54
792.7	8.8	14.3	0.6133	0.4623	0.1510	-3.7	7.115	55
771.8	9.8	13.2	0.6031	0.4350	0.1681	-3.3	5.061	46
750.7	10.8	11.8	0.5965	0.4205	0.1760	-3.2	5.404	46
730.1	11.8	11.0	0.5923	0.4040	0.1889	-2.9	3.656	33
714.2	12.8	9.9	0.5859	0.3896	0.1962	-2.9	2.964	27
696.5	13.8	8.5	0.5798	0.3772	0.2027	-3.0	3.477	35
676.6	14.8	6.7	0.5775	0.3637	0.2138	-3.2	3.472	38
655.1	15.8	5.0	0.5724	0.3439	0.2285	-2.6	3.293	39
638.1	16.8	3.2	0.5636	0.3280	0.2356	-1.3	2.526	34
620.4	17.8	1.5	0.5556	0.3200	0.2356	0.0	2.423	35
602.9	18.8	-0.3	0.5466	0.3161	0.2304	1.7	2.283	37

1FILTERED RADIOMETERSONDE RUN FOR RNB 5 JUN 1973 OPUS 5

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1017.1	0.0	27.6	0.7668	0.7451	0.0217	0.0	17.086	72
987.4	1.0	24.9	0.7474	0.7298	0.0176	0.8	17.745	93
957.5	2.0	23.2	0.7528	0.7537	-0.0009	3.5	16.584	88
926.3	3.0	22.9	0.7444	0.7729	-0.0285	2.2	18.466	95
898.3	4.0	21.6	0.7319	0.7749	-0.0431	-0.5	17.830	97
872.2	5.0	20.3	0.7287	0.7450	-0.0163	-3.6	16.053	95
849.1	6.0	19.1	0.7363	0.7311	0.0052	-4.7	15.354	90
826.2	7.0	18.6	0.7429	0.7199	0.0230	-3.5	12.811	80
804.1	8.0	17.9	0.7378	0.7066	0.0311	-2.7	12.670	77
782.4	9.0	17.0	0.7315	0.6934	0.0381	-2.4	12.083	78
759.8	10.0	15.0	0.7283	0.6801	0.0483	-2.2	10.842	75
733.8	11.0	13.0	0.7228	0.6615	0.0613	-2.0	9.680	76
707.5	12.0	11.1	0.7099	0.6456	0.0643	-1.6	8.273	70
682.6	13.0	9.6	0.7014	0.6289	0.0724	-1.4	6.627	60
660.7	14.0	8.2	0.6954	0.6186	0.0768	-1.8	6.051	59
640.7	15.0	6.8	0.6912	0.6074	0.0837	-2.3	6.121	62
621.2	16.0	5.1	0.6846	0.5930	0.0916	-3.1	5.959	67
597.3	17.0	3.4	0.6740	0.5692	0.1049	-4.3	4.939	62
574.1	18.0	0.5	0.6603	0.5357	0.1246	-6.4	4.390	59
557.2	19.0	-3.2	0.6420	0.4957	0.1463	-8.3	2.774	54
545.9	20.0	-7.5	0.6245	0.4497	0.1748	-9.4	1.928	47
533.4	21.0	-11.2	0.6118	0.4214	0.1905	-7.3	0.930	30
518.7	22.0	-14.8	0.6063	0.3994	0.2069	-3.7		M
504.1	23.0	-17.6	0.6059	0.3930	0.2129	-1.1		M
490.6	24.0	-19.4	0.6003	0.3922	0.2080	0.9	0.096	6
477.1	25.0	-20.7	0.5850	0.3822	0.2028	1.1	0.111	7
462.2	26.0	-22.5	0.5750	0.3736	0.2014	0.8	0.116	8
446.3	27.0	-24.5	0.5756	0.3727	0.2029	0.9	0.105	9
432.0	28.0	-26.7	0.5683	0.3706	0.1977	1.5	0.212	21
418.7	29.0	-28.0	0.5646	0.3705	0.1940	2.2	0.198	22
406.4	30.0	-29.6	0.5551	0.3669	0.1882	2.1	0.181	21
394.7	31.0	-31.4	0.5485	0.3651	0.1834	2.1	0.146	21
383.3	32.0	-33.5	0.5434	0.3625	0.1809	2.2	0.130	21
370.7	33.0	-35.3	0.5374	0.3613	0.1761	2.1	0.114	22
357.1	34.0	-37.2	0.5299	0.3607	0.1692	1.6	0.105	23
343.2	35.0	-38.8	0.5243	0.3588	0.1655	0.1	0.093	24
329.9	36.0	-40.5	0.5213	0.3534	0.1679	-2.8	0.093	27
316.8	37.0	-42.4	0.5209	0.3451	0.1758	-7.6	0.092	31
304.5	38.0	-44.8	0.5310	0.3351	0.1960	-12.4	0.082	34
292.3	39.0	-47.3	0.5549	0.3221	0.2328	-15.8	0.061	34
280.4	40.0	-49.5	0.5770	0.3064	0.2706	-15.2	0.052	34
269.0	41.0	-51.4	0.5923	0.2928	0.2995	-11.3		A
258.8	42.0	-53.0	0.5927	0.2830	0.3096	-6.5		A
249.1	43.0	-53.7	0.5937	0.2759	0.3178	-1.8		A
240.0	44.0	-53.7	0.5890	0.2721	0.3169	1.3		A
232.1	45.0	-54.5	0.5812	0.2714	0.3098	3.3		A
225.0	46.0	-55.3	0.5719	0.2678	0.3041	2.5		A
217.8	47.0	-55.2	0.5638	0.2610	0.3028	0.0		A
210.1	48.0	-61.1	0.5772	0.2725	0.3046	-2.0		A
201.8	49.0	-63.3	0.5828	0.2734	0.3094	-3.3		A
194.3	50.0	-61.1	0.5764	0.2624	0.3140	-4.9		A
187.7	51.0	-55.8	0.5624	0.2427	0.3197	-7.4		A
182.2	52.0	-57.4	0.5698	0.2413	0.3284	-11.0		A
176.9	53.0	-58.1	0.5775	0.2362	0.3413	-12.3		A
172.2	54.0	-58.2	0.5832	0.2286	0.3547	-10.1		A
166.6	55.0	-58.3	0.5853	0.2244	0.3610	-6.1		A
160.5	56.0	-58.5	0.5867	0.2218	0.3649	-3.8		A
153.8	57.0	-58.7	0.5868	0.2207	0.3661	-1.1		A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

1FILTERED RADIOMETERSONDE RUN FOR RNB 6 JUN 1973 OPUS 6

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1016.7	0.0	22.3	0.6348	0.7241	-0.0892	0.0	15.106	91
990.5	1.0	20.0	0.5978	0.7229	-0.1251	8.1	10.296	69
964.1	2.0	17.8	0.5710	0.6959	-0.1249	1.8	10.090	71
937.7	3.0	15.4	0.5522	0.6779	-0.1258	0.4	7.984	72
909.9	4.0	13.8	0.5467	0.6756	-0.1289	0.9	8.404	75
882.6	5.0	13.1	0.5647	0.6970	-0.1323	1.7	8.635	78
856.7	6.0	12.0	0.5682	0.7110	-0.1428	2.4	8.264	83
830.9	7.0	11.4	0.5754	0.7323	-0.1569	2.7	7.940	76
804.0	8.0	11.0	0.5790	0.7494	-0.1705	2.3	8.441	82
777.1	9.0	9.7	0.5693	0.7474	-0.1781	1.9	8.532	88
751.0	10.0	8.2	0.5575	0.7417	-0.1842	1.5	8.725	95
725.9	11.0	6.8	0.5516	0.7433	-0.1917	1.8	8.564	100
702.4	12.0	5.5	0.5466	0.7459	-0.1993	1.6	7.653	95
679.1	13.0	4.5	0.5351	0.7437	-0.2086	1.0	6.219	80
657.1	14.0	2.4	0.5144	0.7220	-0.2076	0.5	4.680	64
634.7	15.0	0.4	0.4912	0.6987	-0.2074	1.0	1.587	27
614.3	16.0	-1.0	0.4780	0.6886	-0.2107	2.1	1.712	29
593.8	17.0	-1.8	0.4820	0.7079	-0.2260	2.8	1.727	30
576.0	18.0	-3.2	0.4768	0.7112	-0.2345	2.8	1.629	31
559.7	19.0	-4.3	0.4735	0.7143	-0.2408	2.3	1.551	31
544.6	20.0	-5.2	0.4709	0.7155	-0.2446	2.4	1.471	30
528.3	21.0	-5.9	0.4644	0.7170	-0.2526	2.5	1.400	30
511.9	22.0	-7.1	0.4569	0.7178	-0.2609	2.1	1.425	32
495.8	23.0	-8.6	0.4493	0.7164	-0.2671	1.3	1.286	32
480.3	24.0	-10.4	0.4425	0.7086	-0.2661	0.5	1.171	32
465.7	25.0	-12.1	0.4355	0.7022	-0.2667	0.6	0.969	30
453.9	26.0	-13.7	0.4309	0.6986	-0.2678	1.5	0.847	28
442.5	27.0	-15.3	0.4295	0.7024	-0.2729	2.2	0.757	29
430.8	28.0	-17.1	0.4236	0.7033	-0.2797	2.0	0.687	29
416.0	29.0	-18.7	0.4189	0.7021	-0.2832	1.4	0.609	29
400.9	30.0	-20.2	0.4131	0.6986	-0.2855	1.1	0.566	29
385.7	31.0	-21.5	0.4082	0.6955	-0.2873	1.0	0.498	28
372.0	32.0	-23.2	0.4042	0.6951	-0.2909	0.9	0.446	28
357.7	33.0	-24.9	0.4003	0.6932	-0.2929	0.7	0.389	28
344.7	34.0	-26.7	0.3971	0.6909	-0.2937	0.2	0.355	28
332.1	35.0	-28.8	0.3932	0.6873	-0.2941	-0.2	0.299	28
320.7	36.0	-30.9	0.3902	0.6823	-0.2921	-0.1	0.251	28
309.8	37.0	-32.7	0.3874	0.6794	-0.2919	0.2	0.232	28
299.7	38.0	-34.4	0.3837	0.6773	-0.2936	0.5	0.198	29
289.3	39.0	-36.5	0.3808	0.6756	-0.2948	0.7	0.167	28
279.0	40.0	-38.5	0.3798	0.6747	-0.2949	1.0	0.139	28
268.7	41.0	-40.4	0.3800	0.6774	-0.2974	1.7	0.121	28
258.5	42.0	-41.8	0.3750	0.6766	-0.3016	2.6	0.109	28
248.7	43.0	-43.2	0.3705	0.6770	-0.3065	3.5	0.097	28
239.0	44.0	-45.0	0.3661	0.6785	-0.3124	4.7	0.087	29
229.2	45.0	-46.5	0.3585	0.6798	-0.3213	5.2	0.076	30
219.9	46.0	-47.8	0.3482	0.6804	-0.3322	4.0	0.076	31
210.7	47.0	-49.1	0.3454	0.6842	-0.3387	1.0	0.065	31
202.5	48.0	-50.6	0.3562	0.6907	-0.3346	-1.6		A
195.7	49.0	-51.3	0.3704	0.6978	-0.3274	-3.0		A
190.1	50.0	-51.8	0.3786	0.7061	-0.3275	-3.3		A
183.8	51.0	-51.9	0.3823	0.7078	-0.3255	-4.1		A
177.1	52.0	-51.9	0.3879	0.7059	-0.3179	-5.0		A
169.9	53.0	-51.6	0.3922	0.7017	-0.3094	-4.4		A
163.3	54.0	-51.1	0.3946	0.7012	-0.3066	-2.5		A
156.6	55.0	-50.6	0.3930	0.6986	-0.3055	-1.4		A
150.4	56.0	-50.3	0.3909	0.6964	-0.3055	-2.1		A
144.8	57.0	-50.1	0.3907	0.6932	-0.3025	-3.3		A
140.0	58.0	-50.5	0.3941	0.6920	-0.2979	-4.9		A
135.0	59.0	-50.9	0.3973	0.6914	-0.2941	-5.4		A
130.0	60.0	-52.0	0.4008	0.6898	-0.2890	-5.0		A

125.0	61.0	-53.3	0.4026	0.6867	-0.2842	-3.5	A
120.0	62.0	-54.6	0.4052	0.6867	-0.2815	-1.7	A
114.9	63.0	-55.2	0.4092	0.6924	-0.2832	-0.5	A
110.2	64.0	-56.1	0.4125	0.6949	-0.2824	-0.3	A
106.0	65.0	-56.0	0.4128	0.6946	-0.2818	-1.3	A
101.7	66.0	-55.7	0.4123	0.6936	-0.2813	-2.1	A
97.3	67.0	-55.7	0.4144	0.6934	-0.2789	-3.5	A
93.8	68.0	-55.8	0.4171	0.6933	-0.2762	-4.6	A
90.9	69.0	-56.1	0.4210	0.6938	-0.2728	-7.0	A

1FILTERED RADIOMETERSONDE RUN FOR RN3 7 AUG 1973 OPUS 7

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1013.9	0.0	29.5	1.1210	0.6136	0.5073	0.0	16.457	64
993.7	1.0	27.6	1.1368	0.6606	0.4763	9.1	15.527	66
972.3	2.0	25.6	1.1349	0.7093	0.4256	14.5	16.984	80
948.4	3.0	23.4	1.1318	0.7676	0.3643	16.1	19.446	100
926.4	4.0	21.5	1.1191	0.8278	0.2913	15.3	17.288	100
905.1	5.0	19.7	1.0940	0.8618	0.2322	10.0	14.212	87
882.5	6.0	18.0	1.0625	0.8544	0.2081	4.0	11.763	80
864.0	7.0	16.6	1.0554	0.8323	0.2181	-0.2	10.078	74
842.9	8.0	15.4	1.0582	0.8287	0.2295	0.7	9.847	74
818.8	9.0	14.1	1.0532	0.8290	0.2243	3.6	9.713	79
791.8	10.0	12.6	1.0212	0.8295	0.1918	4.6	8.916	77
770.6	11.0	11.2	0.9815	0.8169	0.1646	3.1	8.312	76
750.4	12.0	9.6	0.9620	0.7976	0.1645	-1.3	7.439	74
730.6	13.0	8.0	0.9530	0.7712	0.1818	-6.7	6.724	73
711.4	14.0	6.8	0.9525	0.7465	0.2060	-11.4	6.416	73
691.6	15.0	5.6	0.9692	0.7126	0.2566	-14.3	6.064	73
671.0	16.0	4.4	0.9927	0.6753	0.3174	-14.5	5.786	74
650.5	17.0	3.3	1.0127	0.6402	0.3725	-11.0	5.405	72
630.5	18.0	2.1	1.0300	0.6335	0.3965	-6.6	5.233	73
610.0	19.0	0.8	1.0531	0.6446	0.4085	-3.4	4.640	69
589.2	20.0	-0.8	1.0758	0.6613	0.4145	-2.6	4.156	67
570.2	21.0	-2.3	1.1034	0.6820	0.4214	-4.2	3.194	56
552.8	22.0	-3.2	1.1428	0.7095	0.4333	-8.4	2.489	46
535.9	23.0	-4.5	1.2048	0.7406	0.4642	-15.7	2.077	39
519.2	24.0	-6.6	1.2722	0.7550	0.5172	-23.0	2.446	55
503.0	25.0	-8.1	1.3584	0.7549	0.6036	-27.7	3.115	76
486.7	26.0	-8.8	1.4387	0.7530	0.6857	-28.7	3.453	82
470.3	27.0	-9.9	1.5171	0.7508	0.7663	-24.7	2.870	75
453.6	28.0	-11.6	1.5740	0.7410	0.8330	-18.8	2.299	66
437.4	29.0	-13.4	1.6094	0.7324	0.8770	-11.9	1.777	56
421.7	30.0	-15.3	1.6186	0.7275	0.8911	-6.4	1.788	65
407.2	31.0	-17.3	1.6180	0.7208	0.8972	-1.5	1.510	61
393.0	32.0	-19.1	1.6155	0.7104	0.9051	3.3	1.174	54
378.9	33.0	-20.8	1.5862	0.6983	0.8880	9.2	0.963	49
363.9	34.0	-22.8	1.5468	0.6918	0.8549	13.4	0.711	42
347.9	35.0	-25.1	1.5030	0.6953	0.8076	15.1	0.398	28
332.2	36.0	-27.7	1.4702	0.6989	0.7713	16.0	0.299	25
318.3	37.0	-30.5	1.4265	0.6945	0.7320	16.0	0.260	27
305.0	38.0	-33.1	1.3868	0.6926	0.6942	16.6	0.220	29
292.5	39.0	-35.5	1.3480	0.6900	0.6580	17.0	0.197	30

1FILTERED RADIOMETERSONDE RUN FOR RNB 7 AUG 1973 OPUS 8

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1013.8	0.0	29.8	0.6868	0.7204	-0.0336	0.0	14.346	55
982.6	1.0	30.1	0.6603	0.6498	0.0105	-8.3	17.704	61
955.6	2.0	29.1	0.6491	0.6359	0.0133	1.4	17.341	66
933.0	3.0	26.8	0.6362	0.6211	0.0151	-1.0	17.719	73
914.4	4.0	25.1	0.6272	0.6138	0.0135	-1.6	16.560	76
897.0	5.0	23.5	0.6410	0.6130	0.0280	-2.3	13.389	65
876.7	6.0	21.9	0.6389	0.6063	0.0326	-1.9	12.325	65
853.7	7.0	20.3	0.6289	0.5857	0.0432	-1.3	11.324	64
830.7	8.0	18.6	0.6156	0.5752	0.0404	-1.1	10.699	64
809.8	9.0	17.8	0.6100	0.5619	0.0480	-0.7	9.720	64
790.9	10.0	17.4	0.6034	0.5523	0.0510	-0.3	11.288	68
772.0	11.0	17.1	0.5979	0.5472	0.0507	-0.1	10.825	69
752.8	12.0	15.9	0.5900	0.5468	0.0432	-0.6	10.748	71
734.1	13.0	15.1	0.5920	0.5379	0.0541	-1.6	10.408	71
717.3	14.0	13.9	0.5904	0.5323	0.0581	-2.5	9.699	69
702.7	15.0	12.4	0.5925	0.5262	0.0663	-2.0	8.531	66
689.2	16.0	11.4	0.5837	0.5130	0.0707	-1.8	7.985	66
674.9	17.0	10.5	0.5673	0.4941	0.0732	-1.3	8.727	71
658.4	18.0	9.8	0.5536	0.4774	0.0762	-0.9	8.420	75
640.6	19.0	8.1	0.5418	0.4615	0.0802	-0.7	9.565	86
624.1	20.0	6.5	0.5429	0.4624	0.0805	-1.5	7.743	81
610.0	21.0	4.4	0.5424	0.4618	0.0807	-2.2	6.460	73
595.3	22.0	3.0	0.5568	0.4612	0.0956	-1.7	4.330	55
581.0	23.0	1.7	0.5511	0.4512	0.0999	-1.0	3.824	51
567.1	24.0	1.3	0.5391	0.4478	0.0913	-0.3	3.367	45
554.6	25.0	1.0	0.5301	0.4353	0.0948	-1.0	3.414	45
541.7	26.0	0.7	0.5271	0.4250	0.1021	-1.8	3.522	47
528.9	27.0	0.5	0.5177	0.4127	0.1050	-1.3	4.892	65
515.1	28.0	0.6	0.5095	0.4027	0.1068	-0.8	5.621	72
500.8	29.0	0.5	0.4990	0.3923	0.1067	-1.6	4.697	58
487.3	30.0	-0.0	0.4915	0.3811	0.1104	-3.2	3.882	49
474.9	31.0	-1.3	0.4883	0.3664	0.1219	-4.0	2.932	39
462.7	32.0	-2.9	0.4905	0.3557	0.1349	-3.7	4.147	62
450.4	33.0	-4.1	0.4870	0.3494	0.1376	-2.9	4.141	66
438.8	34.0	-4.7	0.4810	0.3407	0.1403	-2.5	4.118	66
428.0	35.0	-5.2	0.4762	0.3278	0.1485	-2.5	3.848	63
416.9	36.0	-5.9	0.4692	0.3154	0.1538	-2.2	3.539	60
406.3	37.0	-6.9	0.4602	0.3058	0.1544	-2.6	3.337	58
395.4	38.0	-7.9	0.4547	0.2968	0.1578	-3.9	2.610	49
384.3	39.0	-9.0	0.4554	0.2850	0.1704	-5.7	2.118	42
374.4	40.0	-10.3	0.4557	0.2736	0.1820	-5.6	1.651	35
365.3	41.0	-11.8	0.4556	0.2641	0.1915	-3.6	2.083	49
355.2	42.0	-13.4	0.4509	0.2558	0.1951	-2.3	1.980	51
344.3	43.0	-14.5	0.4428	0.2484	0.1944	-2.6	1.150	32
333.6	44.0	-15.7	0.4394	0.2386	0.2008	-3.9	1.496	43
323.3	45.0	-17.0	0.4377	0.2253	0.2124	-5.0	1.203	39
314.0	46.0	-18.3	0.4337	0.2133	0.2204	-4.8	1.046	36
306.1	47.0	-19.2	0.4263	0.2011	0.2252	-4.[illegible]	0.938	34
297.7	48.0	-20.0	0.4204	0.1897	0.2307	-3.6	0.606	23
288.1	49.0	-21.0	0.4168	0.1799	0.2369	-3.9	0.350	14
278.2	50.0	-22.0	0.4132	0.1709	0.2423	-4.2	0.323	14
268.7	51.0	-22.9	0.4094	0.1589	0.2504	-4.8	0.306	13
260.3	52.0	-23.7	0.4032	0.1450	0.2581	-4.6	0.300	13
253.0	53.0	-24.8	0.3933	0.1335	0.2648	-1.9	0.294	15
245.5	54.0	-26.2	0.3935	0.1270	0.2665	2.1	0.296	16
237.6	55.0	-27.5	0.3817	0.1227	0.2590	4.9	0.260	15
229.7	56.0	-29.2	0.3644	0.1165	0.2478	3.6	0.248	16
221.8	57.0	-31.1	0.3467	0.1052	0.2416	-1.0	0.286	22
213.1	58.0	-33.0	0.3421	0.0915	0.2506	-6.1	0.304	27
205.3	59.0	-34.1	0.3451	0.0809	0.2643	-9.5	0.309	29
198.7	60.0	-35.2	0.3509	0.0734	0.2775	-9.3		A

192.1	61.0	-36.6	0.3584	0.0706	0.2878	-7.0	A
184.9	62.0	-38.9	0.3631	0.0695	0.2936	-5.4	A
178.2	63.0	-41.2	0.3626	0.0661	0.2965	-5.8	A
171.9	64.0	-43.5	0.3673	0.0626	0.3047	-8.0	A
166.1	65.0	-45.4	0.3861	0.0657	0.3144	-8.3	A
159.9	66.0	-47.2	0.3959	0.0691	0.3267	-5.2	A
152.9	67.0	-48.2	0.3965	0.0671	0.3294	-1.1	A
145.0	68.0	-48.9	0.3876	0.0609	0.3267	2.3	A
136.7	69.0	-49.3	0.3768	0.0557	0.3212	3.0	A
130.8	70.0	-50.1	0.3725	0.0567	0.3158	-0.8	A
127.6	71.0	-51.6	0.3805	0.0624	0.3180	-9.6	A
126.1	72.0	-52.8	0.3951	0.0637	0.3314	-16.8	A
123.9	73.0	-53.4	0.4012	0.0633	0.3378	-10.9	A
121.0	74.0	-53.4	0.3996	0.0623	0.3373	-5.3	A
116.8	75.0	-53.9	0.4030	0.0628	0.3402	-5.3	A
112.2	76.0	-54.3	0.4102	0.0643	0.3459	-7.4	A
108.1	77.0	-54.5	0.4160	0.0638	0.3521	-9.0	A
104.8	78.0	-54.5	0.4234	0.0664	0.3570	-9.6	A
102.3	79.0	-55.0	0.4345	0.0715	0.3630	-7.1	A
99.8	80.0	-55.4	0.4399	0.0750	0.3649	-7.6	A
97.0	81.0	-55.5	0.4405	0.0761	0.3645	-8.0	A
93.8	82.0	-55.4	0.4427	0.0685	0.3741	-7.4	A
90.6	83.0	-55.7	0.4435	0.0654	0.3781	-4.4	A
87.5	84.0	-56.0	0.4486	0.0709	0.3777	-0.9	A
84.3	85.0	-55.9	0.4529	0.0786	0.3744	-1.9	A
81.5	86.0	-55.5	0.4574	0.0791	0.3783	-5.0	A
79.2	87.0	-55.8	0.4591	0.0767	0.3823	-6.1	A
77.5	88.0	-56.5	0.4649	0.0805	0.3843	1.6	A
75.7	89.0	-57.0	0.4676	0.0852	0.3824	13.7	A
73.9	90.0	-56.9	0.4649	0.0891	0.3757	16.0	A
72.1	91.0	-56.8	0.4604	0.0949	0.3656	6.7	A
70.3	92.0	-56.7	0.4649	0.0967	0.3682	-8.4	A
68.4	93.0	-56.7	0.4730	0.0972	0.3757	-23.8	A

1FILTERED RADIOMETERSONDE RUN FOR RNB 8 AUG 1973 OPUS 9

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1015.0	0.0	25.5	0.6486	0.6466	0.0020	0.0	19.001	92
981.2	1.0	25.4	0.7107	0.6153	0.0954	-15.7	18.665	88
950.3	2.0	24.3	0.7034	0.5939	0.1095	-4.3	17.440	87
923.2	3.0	22.3	0.6991	0.5774	0.1217	-2.0	15.127	81
896.0	4.0	20.0	0.6935	0.5625	0.1310	-1.0	13.770	84
867.6	5.0	17.4	0.6869	0.5545	0.1323	-0.0	11.037	75
840.3	6.0	15.7	0.6752	0.5476	0.1276	0.4	9.647	75
815.6	7.0	14.8	0.6652	0.5415	0.1238	-0.0	9.961	74
791.2	8.0	14.2	0.6552	0.5279	0.1274	-0.4	9.635	75
765.6	9.0	12.6	0.6519	0.5193	0.1326	-0.5	8.396	69
740.6	10.0	11.0	0.6456	0.5143	0.1313	-0.4	7.976	72
716.6	11.0	9.6	0.6393	0.5078	0.1315	-0.7	6.912	64
694.3	12.0	8.1	0.6304	0.4953	0.1352	-1.3	6.276	63
672.9	13.0	6.1	0.6189	0.4738	0.1451	-1.4	6.151	71
651.9	14.0	4.2	0.6070	0.4587	0.1483	-1.4	6.222	78
629.8	15.0	2.6	0.6013	0.4500	0.1514	-1.3	5.361	72
607.1	16.0	0.7	0.5964	0.4391	0.1573	-1.4	3.982	60
585.1	17.0	-1.2	0.5905	0.4264	0.1641	-1.2	3.149	52
565.3	18.0	-2.9	0.5814	0.4143	0.1671	-0.8	4.069	73
546.7	19.0	-4.5	0.5720	0.4047	0.1672	-0.6	2.112	42
527.7	20.0	-6.1	0.5645	0.3959	0.1686	-0.8	3.443	73
508.3	21.0	-7.5	0.5550	0.3825	0.1725	-1.4	3.964	93
490.1	22.0	-9.0	0.5461	0.3681	0.1780	-1.9	3.555	89
472.7	23.0	-10.8	0.5382	0.3530	0.1852	-1.7	3.434	94
455.3	24.0	-12.9	0.5323	0.3406	0.1917	-1.4	2.966	96
437.7	25.0	-15.1	0.5247	0.3338	0.1909	-1.7	2.507	90
421.5	26.0	-16.9	0.5195	0.3237	0.1957	-2.5	2.104	87
405.4	27.0	-18.4	0.5148	0.3073	0.2075	-3.3	1.838	84
389.3	28.0	-20.0	0.5094	0.2913	0.2181	-3.1	1.909	93
372.8	29.0	-21.9	0.5024	0.2768	0.2257	-2.7	1.581	90
357.2	30.0	-24.0	0.4947	0.2652	0.2295	-2.7	1.320	84
342.0	31.0	-25.9	0.4898	0.2517	0.2381	-3.1	1.042	76
326.9	32.0	-27.9	0.4838	0.2362	0.2476	-3.6	0.810	68
310.5	33.0	-29.9	0.4766	0.2189	0.2577	-3.9	0.650	62
294.9	34.0	-32.0	0.4688	0.2007	0.2682	-4.2	0.520	57
281.7	35.0	-34.0	0.4620	0.1835	0.2784	-4.5	0.382	50
269.6	36.0	-36.0	0.4551	0.1664	0.2887	-3.6	0.329	48
256.3	37.0	-37.5	0.4480	0.1497	0.2963	-0.9	0.287	48
243.1	38.0	-39.2	0.4323	0.1352	0.2970	2.7	0.271	50
231.0	39.0	-41.1	0.4046	0.1203	0.2844	6.1	0.256	56
218.7	40.0	-43.9	0.3706	0.1044	0.2662	8.0	0.224	60
206.1	41.0	-47.8	0.3419	0.0930	0.2489	9.2	0.165	66
194.1	42.0	-52.6	0.3242	0.0929	0.2313	10.0		A
184.3	43.0	-57.3	0.3124	0.1036	0.2088	10.5		A
175.2	44.0	-60.2	0.3056	0.1114	0.1942	9.5		A
167.3	45.0	-61.8	0.3013	0.1195	0.1817	9.3		A

1FILTERED RADIOMETERSONDE RUN FOR RNB 8 AUG 1973 OPUS 10

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1016.4	0.0	29.1	0.6805	0.9045	-0.2240	0.0	23.310	89
985.1	1.0	26.4	0.8408	0.8761	-0.0353	-35.7	20.441	94
957.2	2.0	24.1	0.8355	0.8544	-0.0190	-3.0	17.654	88
933.8	3.0	22.8	0.8252	0.8342	-0.0090	-2.7	14.991	80
910.9	4.0	21.7	0.8201	0.8203	-0.0002	-2.1	13.993	78
885.3	5.0	20.3	0.8253	0.8151	0.0101	-1.4	12.513	72
859.2	6.0	18.8	0.8239	0.8081	0.0158	-0.6	11.825	76
832.8	7.0	17.2	0.8074	0.7952	0.0122	0.3	11.553	75
808.1	8.0	15.7	0.7906	0.7796	0.0109	0.2	8.862	65
783.2	9.0	13.7	0.7704	0.7635	0.0069	-0.1	8.506	67
759.4	10.0	11.9	0.7700	0.7551	0.0149	-0.2	8.148	70
734.6	11.0	10.0	0.7588	0.7463	0.0125	-0.6	7.614	72
710.3	12.0	8.1	0.7465	0.7340	0.0125	-1.1	7.446	77
687.1	13.0	6.6	0.7425	0.7213	0.0212	-1.5	6.730	76
664.7	14.0	4.9	0.7453	0.7124	0.0328	-1.8	6.628	78
642.3	15.0	3.4	0.7415	0.7088	0.0327	-1.6	6.457	87
619.7	16.0	1.9	0.7328	0.6915	0.0414	-1.7	6.692	92
597.0	17.0	0.8	0.7274	0.6804	0.0470	-2.1	6.244	92
575.3	18.0	-0.7	0.7268	0.6680	0.0588	-2.5	5.100	80
556.2	19.0	-2.1	0.7214	0.6589	0.0625	-3.1	4.587	77
538.6	20.0	-3.8	0.7200	0.6433	0.0767	-3.1	4.138	76
521.4	21.0	-5.1	0.7200	0.6320	0.0881	-2.4	3.593	73
503.3	22.0	-6.0	0.7207	0.6277	0.0931	-1.1	3.206	64
485.7	23.0	-6.9	0.7206	0.6297	0.0909	-0.7	2.206	47
468.8	24.0	-8.6	0.7205	0.6281	0.0924	-1.5	2.362	55
452.7	25.0	-10.5	0.7153	0.6173	0.0981	-2.9	2.099	55
436.2	26.0	-12.5	0.7120	0.6018	0.1103	-4.0	1.841	55
420.2	27.0	-14.6	0.7098	0.5883	0.1214	-3.7	1.556	52
404.7	28.0	-16.7	0.7143	0.5783	0.1359	-2.3	1.259	50
389.3	29.0	-18.8	0.7146	0.5797	0.1348	-0.9	0.788	35
372.1	30.0	-20.7	0.7131	0.5791	0.1340	-0.6	0.861	43
356.3	31.0	-22.6	0.7088	0.5738	0.1350	-2.0	0.697	39
342.2	32.0	-24.7	0.7089	0.5647	0.1442	-4.0	0.532	35
330.3	33.0	-26.7	0.7105	0.5559	0.1546	-5.3	0.445	34
318.1	34.0	-28.9	0.7103	0.5400	0.1703	-3.8	0.373	33
305.5	35.0	-31.2	0.7067	0.5297	0.1770	-3.1	0.277	30
292.3	36.0	-33.4	0.7038	0.5305	0.1734	-3.0	0.236	30
280.3	37.0	-35.8	0.7067	0.5200	0.1867	-2.4	0.199	30
269.7	38.0	-38.3	0.7074	0.5111	0.1963	-0.5	0.159	31
258.8	39.0	-40.9	0.7065	0.5177	0.1888	2.5	0.127	30
247.3	40.0	-43.3	0.7050	0.5275	0.1775	3.6	0.102	30
235.8	41.0	-46.1	0.7083	0.5359	0.1724	2.1	0.085	31
225.0	42.0	-48.6	0.7131	0.5435	0.1696	-1.9	0.065	32
215.3	43.0	-50.9	0.7163	0.5429	0.1735	-7.7		A
206.9	44.0	-52.9	0.7199	0.5270	0.1930	-10.3		A
198.9	45.0	-54.0	0.7229	0.5017	0.2212	-8.2		A
189.7	46.0	-55.4	0.7240	0.5027	0.2213	-4.3		A
180.3	47.0	-57.5	0.7223	0.5024	0.2199	-3.4		A
172.2	48.0	-59.8	0.7232	0.4970	0.2261	-5.1		A
164.3	49.0	-60.8	0.7326	0.4889	0.2437	-7.3		A
156.8	50.0	-62.3	0.7370	0.4913	0.2456	-4.2		A
149.5	51.0	-64.4	0.7439	0.4863	0.2576	1.0		A
143.3	52.0	-66.5	0.7451	0.4999	0.2453	11.8		A
136.7	53.0	-68.3	0.7416	0.5037	0.2379	13.4		A
129.7	54.0	-69.7	0.7347	0.5443	0.1905	7.9		A
124.2	55.0	-69.5	0.7343	0.5254	0.2089	0.1		A
118.2	56.0	-68.0	0.7384	0.5188	0.2196	-9.7		A
112.2	57.0	-65.9	0.7391	0.5164	0.2227	-6.4		A
99.2	59.0	-64.5	0.7504	0.5164	0.2340	-8.3		A
94.4	60.0	-64.7	0.7560	0.5115	0.2444	-10.7		A
90.3	61.0	-66.0	0.7646	0.5117	0.2529	-11.5		A
87.0	62.0	-66.5	0.7661	0.5071	0.2590	-10.6		A
84.5	63.0	-66.6	0.7636	0.4998	0.2638	-11.1		A

1FILTERED RADIOMETERSONDE RUN FOR RNB 8 AUG 1973 OPUS 11

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1014.7	0.0	33.1	0..7173	0.7011	0.0162	0.0	23.590	83
989.0	1.0	25.0	0.8031	0.7214	0.0817	-15.0	14.524	76
963.1	2.0	21.0	0.7816	0.7179	0.0637	1.7	14.084	86
937.3	3.0	19.4	0.7674	0.7178	0.0496	0.9	13.305	86
910.8	4.0	17.7	0.7675	0.7163	0.0512	-2.1	10.712	77
886.6	5.0	16.2	0.7698	0.7005	0.0693	-4.1	9.704	75
863.3	6.0	15.2	0.7785	0.6796	0.0988	-3.8	9.737	76
840.3	7.0	14.2	0.7840	0.6742	0.1097	-1.8	8.031	67
817.3	8.0	12.9	0.7833	0.6771	0.1062	-0.1	8.085	70
794.5	9.0	11.6	0.7749	0.6738	0.1011	0.0	7.643	70
771.3	10.0	10.1	0.7638	0.6579	0.1059	-0.3	7.195	71
748.0	11.0	8.6	0.7595	0.6501	0.1094	-0.4	6.719	71
726.1	12.0	7.2	0.7569	0.6482	0.1088	-0.0	6.586	74
704.7	13.0	5.8	0.7495	0.6425	0.1069	0.3	6.021	73
684.3	14.0	4.7	0.7414	0.6336	0.1078	0.6	5.772	74
664.8	15.0	3.3	0.7364	0.6311	0.1053	0.4	5.940	79
646.3	16.0	2.0	0.7279	0.6290	0.0989	0.0	5.369	80
626.5	17.0	0.7	0.7227	0.6185	0.1041	-0.6	5.426	82
605.0	18.0	-0.4	0.7176	0.6096	0.1080	-0.7	5.256	86
583.3	19.0	-1.9	0.7167	0.6053	0.1114	-0.4	4.401	76
564.2	20.0	-3.3	0.7092	0.6020	0.1072	-0.4	3.845	72
548.2	21.0	-4.7	0.7056	0.5949	0.1107	-1.0	3.510	72
532.3	22.0	-5.6	0.7006	0.5855	0.1151	-1.4	3.260	68
515.5	23.0	-6.4	0.6978	0.5760	0.1218	-1.0	2.876	61
497.6	24.0	-7.6	0.6926	0.5711	0.1216	-0.7	2.553	58
480.5	25.0	-9.3	0.6883	0.5669	0.1214	-0.7	2.143	54
463.7	26.0	-10.9	0.6864	0.5606	0.1257	-1.0	1.768	49
447.0	27.0	-12.6	0.6846	0.5549	0.1298	-1.1	1.737	53
429.7	28.0	-14.5	0.6836	0.5522	0.1313	-1.5	1.680	57
415.1	29.0	-16.1	0.6811	0.5471	0.1340	-2.4	1.413	54
403.2	30.0	-17.7	0.6791	0.5363	0.1429	-2.9	0.987	41
392.4	31.0	-19.2	0.6774	0.5261	0.1513	-1.9	0.983	46
378.2	32.0	-20.6	0.6748	0.5219	0.1529	-0.8	0.778	39
361.0	33.0	-22.3	0.6689	0.5190	0.1499	-0.6	0.623	35
343.6	34.0	-24.5	0.6681	0.5138	0.1543	-1.4	0.523	34
330.3	35.0	-26.4	0.6674	0.5088	0.1585	-3.2	0.442	33
319.2	36.0	-28.3	0.6646	0.4984	0.1663	-4.0	0.318	26
307.1	37.0	-30.2	0.6662	0.4870	0.1792	-3.6	0.259	26
294.1	38.0	-32.5	0.6725	0.4878	.1846	-2.8	0.225	26
283.5	39.0	-34.8	0.6796	0.4940	0.1856	-2.2	0.170	24
274.7	40.0	-36.8	0.6805	0.4902	0.1903	-2.4	0.148	25
264.[illegible]	41.0	-39.3	0.6818	0.4859	0.1959	-3.4	0.134	26
252.3	42.0	-41.7	0.6904	0.4899	0.2005	-4.9	0.100	27
240.3	43.0	-43.9	0.7085	0.4964	0.2122	-7.1	0.088	25
229.7	44.0	-45.7	0.7273	0.4969	0.2304	-8.5	0.067	24
220.1	45.0	-47.5	0.7388	0.4900	0.2487	-9.3	0.055	24
211.3	46.0	-49.6	0.7391	0.4832	0.2558	-9.1	0.055	26
202.6	47.0	-51.7	0.7500	0.4773	0.2727	-9.6		A
193.1	48.0	-53.5	0.7661	0.4774	0.2887	-11.5		A
183.1	49.0	-54.9	0.7857	0.4779	0.3078	-13.0		A
174.0	50.0	-56.8	0.8086	0.4784	0.3302	-15.4		A
166.2	51.0	-58.6	0.8357	0.4814	0.3543	-17.7		A
158.7	52.0	-59.7	0.8577	0.4810	0.3767	-18.8		A
150.9	53.0	-61.0	0.8813	0.4777	0.4036	-20.5		A
143.4	54.0	-62.7	0.9069	0.4779	0.4290	-21.1		A
136.6	55.0	-64.3	0.9398	0.4824	0.4573	-18.8		A
130.2	56.0	-64.6	0.9653	0.4863	0.4790	-14.1		A
124.3	57.0	-63.9	0.9722	0.4866	0.4855	-7.9		A
118.5	58.0	-62.5	0.9750	0.4867	0.4883	-5.8		A
112.3	59.0	-61.4	0.9791	0.4856	0.4935	-4.7		A
105.9	60.0	-60.8	0.9853	0.4806	0.5047	-2.3		A

99.8	61.0	-60.9	0.9816	0.4799	0.5018	1.7	A
94.4	62.0	-61.6	0.9818	0.4856	0.4961	5.8	A
89.7	63.0	-61.6	0.9785	0.4890	0.4895	7.6	A
[illegible]	64.0	-60.3	0.9699	0.4846	0.4853	11.1	A
80.7	65.0	-58.3	0.9550	0.4794	0.4756	15.0	A
77.4	66.0	-56.7	0.9394	0.4761	0.4633	18.1	A
74.3	67.0	-56.5	0.9280	0.4773	0.4507	16.2	A
69.8	68.0	-56.7	0.9262	0.4840	0.4422	14.0	A
64.9	69.0	-57.0	0.9216	0.4879	0.4336	16.4	A
60.3	70.0	-56.6	0.9052	0.4869	0.4183	19.0	A
56.8	71.0	-56.1	0.8911	0.4896	0.4015	20.4	A
54.0	72.0	-55.0	0.8863	0.4928	0.3935	20.5	A
50.9	73.0	-53.9	0.8828	0.4956	0.3871	22.1	A
48.3	74.0	-53.1	0.8676	0.4944	0.3732	28.0	A
45.7	75.0	-52.4	0.8514	0.4924	0.3589	27.0	A
42.9	76.0	-51.5	0.8402	0.4970	0.3432	18.9	A
40.4	77.0	-50.3	0.8407	0.5005	0.3402	4.8	A
38.6	78.0	-49.1	0.8364	0.4923	0.3441	-1.9	A
37.3	79.0	-47.7	0.8269	0.4773	0.3496	15.2	A
35.7	80.0	-47.0	0.8143	0.4729	0.3413	38.6	A
34.1	81.0	-46.3	0.8007	0.4785	0.3222	49.0	A
31.9	82.0	-45.4	0.7947	0.4926	0.3021	43.7	A
30.3	83.0	-44.4	0.7913	0.4970	0.2943	31.6	A
28.7	84.0	-43.5	0.7913	0.5030	0.2883	20.9	A
27.3	85.0	-42.3	0.7914	0.5079	0.2835	15.1	A
25.6	86.0	-40.9	0.7902	0.5093	0.2809	13.2	A
24.5	87.0	-39.7	0.7856	0.5068	0.2787	12.9	A
23.7	88.0	-38.5	0.7785	0.5024	0.2761	15.5	A
23.1	89.0	-37.4	0.7710	0.4962	0.2749	17.1	A
22.1	90.0	-36.7	0.7636	0.4926	0.2710	10.6	A
20.7	91.0	-36.3	0.7628	0.4931	0.2697	9.5	A
19.3	92.0	-35.8	0.7670	0.4991	0.2679	7.2	A
17.8	93.0	-35.4	0.7696	0.5037	0.2659	7.5	A
16.1	94.0	-34.9	0.7730	0.5092	0.2637	7.4	A

1FILTERED RADIOMETERSONDE RUN FOR RN3 8 AUG 1973 OPUS 12

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1013.1	0.0	31.5	0.7024	0.6904	0.0120	0.0	22.381	89
990.6	1.0	27.6	0.8470	0.6489	0.1981	-48.6	17.194	72
964.9	2.0	25.6	0.8343	0.6371	0.1972	-0.9	15.755	73
937.2	3.0	23.1	0.8187	0.6275	0.1912	1.2	14.364	76
904.5	4.0	20.8	0.8045	0.6240	0.1805	1.0	15.056	87
875.1	5.0	19.3	0.7946	0.6180	0.1766	0.4	14.712	92
849.5	6.0	17.6	0.7874	0.6094	0.1780	-0.3	11.695	76
822.9	7.0	15.6	0.7803	0.5964	0.1838	-0.8	10.976	81
795.3	8.0	13.7	0.7811	0.5968	0.1843	-0.7	11.501	94
767.7	9.0	12.4	0.7824	0.5915	0.1909	-0.1	11.059	92
740.0	10.0	11.1	0.7778	0.5867	0.1911	0.8	9.282	83
713.3	11.0	9.2	0.7656	0.5838	0.1818	1.8	8.658	84
689.0	12.0	7.2	0.7635	0.5938	0.1696	1.8	7.754	83
667.0	13.0	5.4	0.7692	0.6058	0.1634	0.1	6.909	83
645.8	14.0	4.1	0.7814	0.6170	0.1645	-3.7	6.783	84
625.1	15.0	2.8	0.8023	0.6203	0.1821	-8.1	7.006	92
605.3	16.0	1.4	0.8370	0.6108	0.2262	-10.6	6.190	89
585.5	17.0	0.2	0.8678	0.5959	0.2720	-10.5	4.745	71
565.3	18.0	-1.2	0.8844	0.5841	0.3002	-8.0	4.510	72
545.2	19.0	-2.6	0.8958	0.5727	0.3232	-1.5	4.297	75
525.7	20.0	-3.9	0.9095	0.5743	0.3351	8.4	4.050	72
506.1	21.0	-5.4	0.9084	0.6279	0.2805	18.2	3.608	72
487.3	22.0	-7.4	0.8945	0.7123	0.1822	20.2	3.006	65
469.7	23.0	-9.0	0.8826	0.7757	0.1069	12.5	2.476	61
453.0	24.0	-10.7	0.8828	0.7740	0.1088	1.1	1.994	52
437.3	25.0	-12.5	0.8933	0.7583	0.1350	-5.7	1.789	54
422.7	26.0	-14.5	0.9081	0.7544	0.1536	-4.0	1.595	54
408.2	27.0	-16.5	0.9250	0.7664	0.1586	0.4	1.412	53
392.9	28.0	-18.3	0.9341	0.7864	0.1477	2.6	1.122	50
376.9	29.0	-20.3	0.9365	0.8032	0.1333	-0.8	0.937	45
360.1	30.0	-22.2	0.9328	0.8007	0.1322	-11.1	0.656	37
342.7	31.0	-24.8	0.9180	0.7413	0.1767	-25.6	0.428	28
326.3	32.0	-27.4	0.9139	0.6293	0.2846	-37.1	0.422	34
312.1	33.0	-29.7	0.9172	0.5031	0.4140	-37.7	0.313	30
299.8	34.0	-32.1	0.9247	0.4342	0.4905	-26.8	0.214	24
288.0	35.0	-34.7	0.9163	0.4064	0.5099	-12.6	0.228	32
275.7	36.0	-37.2	0.9102	0.3910	0.5192	-6.1	0.231	40
264.7	37.0	-39.2	0.9046	0.3762	0.5284	-8.1	0.218	44
255.7	38.0	-41.0	0.9049	0.3652	0.5397	-14.0	0.199	47
247.9	39.0	-42.7	0.9254	0.3568	0.5686	-23.8	0.183	50
239.2	40.0	-44.9	0.9664	0.3598	0.6065	-33.6	0.153	51
228.4	41.0	-47.6	1.0447	0.3733	0.6714	-46.0	0.117	50
216.6	42.0	-50.8	1.1656	0.3946	0.7710	-57.4		A
204.7	43.0	-53.5	1.3282	0.4153	0.9129	-59.5		A
194.3	44.0	-56.0	1.4754	0.4330	1.0425	-41.5		A
184.7	45.0	-58.6	1.5503	0.4584	1.0919	-5.2		A
176.0	46.0	-60.6	1.5261	0.4918	1.0343	25.3		A
168.3	47.0	-61.8	1.4795	0.5220	0.9576	31.0		A
161.7	48.0	-62.8	1.4769	0.5417	0.9352	15.9		A
155.1	49.0	-64.9	1.5001	0.5536	0.9465	4.8		A
147.9	50.0	-66.5	1.5080	0.5611	0.9468	5.0		A
141.3	51.0	-67.3	1.4859	0.5619	0.9240	8.1		A
134.5	52.0	-67.7	1.4780	0.5606	0.9175	5.4		A
127.2	53.0	-67.7	1.4739	0.5601	0.9138	1.0		A
120.3	54.0	-67.6	1.4780	0.5584	0.9196	2.6		A
114.9	55.0	-67.6	1.4767	0.5593	0.9174	9.7		A
109.8	56.0	-67.9	1.4615	0.5597	0.9018	16.7		A
104.0	57.0	-68.0	1.4399	0.5632	0.8767	13.9		A
98.2	58.0	-67.8	1.4251	0.5632	0.8619	8.0		A
93.2	59.0	-67.4	1.4322	0.5603	0.8719	4.3		A
89.0	60.0	-66.0	1.4228	0.5545	0.8682	5.2		A

84.9	61.0	-63.6	1.4060	0.5496	0.8563	5.8		A
80.7	62.0	-61.3	1.3972	0.5464	0.8508	0.8		A
76.3	63.0	-60.8	1.4023	0.5426	0.8597	2.2		A
71.8	64.0	-61.3	1.3998	0.5360	0.8638	12.3		A
67.7	65.0	-62.3	1.3769	0.5353	0.8416	30.6		A
64.0	66.0	-63.2	1.3955	0.5396	0.8159	42.7		A
60.6	67.0	-62.8	1.3241	0.5424	0.7816	43.1		A
57.2	68.0	-61.2	1.3013	0.5391	0.7622	30.1		A
54.0	69.0	-59.5	1.2794	0.5358	0.7437	5.9		A
50.8	70.0	-58.4	1.2864	0.5366	0.7504	-14.5		A
47.6	71.0	-57.4	1.2983	0.5266	0.7714	-24.0		A
44.7	72.0	-56.2	1.3067	0.5193	0.7874	-11.2		A
42.4	73.0	-55.3	1.2951	0.5099	0.7852	17.6		A
40.2	74.0	-55.1	1.2755	0.5071	0.7684	49.2		A
38.1	75.0	-55.0	1.2563	0.5110	0.7453	63.8		A
35.9	76.0	-53.5	1.2292	0.5122	0.7170	64.5		A
33.9	77.0	-51.2	1.2040	0.5109	0.6931	47.5		A
32.1	78.0	-49.3	1.1911	0.5091	0.6820	21.9		A
30.4	79.0	-48.5	1.1947	0.5087	0.6860	6.8		A
28.7	80.0	-48.5	1.1893	0.5021	0.6872	12.9		A
27.0	81.0	-48.2	1.1778	0.4970	0.6808	32.1		A
25.4	82.0	-47.7	1.1635	0.4973	0.6662	46.9		A
23.9	83.0	-47.4	1.1525	0.5003	0.6522	46.6		A
22.5	84.0	-47.5	1.1423	0.5025	0.6397	34.4		A
21.2	85.0	-46.2	1.1363	0.5000	0.6363	31.2		A
20.0	86.0	-44.3	1.1317	0.4976	0.6341	28.8		A
17.6	88.0	-42.4	1.1116	0.4984	0.6133	24.0		A
16.2	89.0	-42.7	1.1054	0.4991	0.6063	3.0		A
14.7	90.0	-42.7	1.1030	0.4937	0.6093	-12.0		A
13.1	91.0	-42.8	1.1034	0.4855	0.6179	-31.5		A

1FILTERED RADIOMETERSONDE RUN FOR RND 9 AUG 1973 OPUS 13

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1016.5	0.0	31.5	0.7024	0.8013	-0.0989	0.0	23.160	90
982.1	1.0	24.9	0.8103	0.8129	-0.0026	-16.5	18.283	91
950.5	2.0	21.8	0.8069	0.7952	0.0117	-0.3	14.742	85
922.3	3.0	20.3	0.7931	0.7810	0.0121	-0.5	12.259	75
894.4	4.0	19.0	0.7818	0.7739	0.0079	0.0	8.839	56
867.7	5.0	17.1	0.7852	0.7733	0.0120	0.2	8.646	61
841.4	6.0	15.2	0.7830	0.7714	0.0115	0.2	7.861	62
816.3	7.0	13.5	0.7764	0.7702	0.0061	-0.2	6.844	56
792.0	8.0	12.2	0.7710	0.7635	0.0075	-1.5	6.241	55
769.0	9.0	10.7	0.7633	0.7459	0.0174	-3.5	6.046	57
745.7	10.0	9.2	0.7516	0.7159	0.0357	-4.9	5.236	54
722.5	11.0	7.3	0.7417	0.6797	0.0620	-5.1	5.636	63
699.7	12.0	5.3	0.7336	0.6512	0.0824	-4.3	5.417	67
677.0	13.0	3.3	0.7260	0.6328	0.0932	-3.3	5.058	71
654.0	14.0	1.5	0.7178	0.6142	0.1036	-2.3	5.277	80
632.3	15.0	-0.2	0.7113	0.5967	0.1147	-1.3	4.786	79
611.6	16.0	-1.8	0.7005	0.5865	0.1140	0.3	4.666	85
591.1	17.0	-3.2	0.6915	0.5808	0.1107	1.7	4.174	81
571.2	18.0	-4.6	0.6809	0.5809	0.1000	2.0	3.601	75
553.2	19.0	-6.1	0.6764	0.5834	0.0930	1.7	3.214	73
535.6	20.0	-7.6	0.6753	0.5842	0.0911	1.3	3.175	78
517.1	21.0	-8.8	0.6773	0.5884	0.0889	1.0	3.099	81
498.2	22.0	-10.3	0.6795	0.5978	0.0817	-0.2	2.602	72
479.8	23.0	-12.2	0.6803	0.5978	0.0825	-2.1	2.211	71
462.2	24.0	-14.2	0.6845	0.5867	0.0978	-3.6	1.867	67
444.8	25.0	-15.9	0.6858	0.5736	0.1123	-3.4	1.638	65
428.2	26.0	-17.7	0.6817	0.56[illegible]	0.1203	-1.8	1.408	62
411.9	27.0	-19.6	0.6766	0.5567	0.1199	-0.9	1.164	58
396.0	28.0	-21.7	0.6755	0.5561	0.1193	-1.1	1.055	61
379.8	29.0	-23.9	0.6786	0.5540	0.1246	-2.3	0.908	61
364.4	30.0	-26.1	0.6805	0.5470	0.1335	-4.0	0.706	56
349.5	31.0	-28.3	0.6814	0.5380	0.1434	-5.7	0.534	50
335.4	32.0	-30.4	0.6893	0.5272	0.1620	-7.4	0.411	44
321.7	33.0	-32.5	0.6980	0.5174	0.1806	-8.0	0.335	43
309.2	34.0	-34.8	0.7053	0.5035	0.2018	-8.4	0.287	43
296.8	35.0	-37.0	0.7096	0.4963	0.2133	-8.4	0.222	41
285.3	36.0	-39.0	0.7174	0.4823	0.2351	-7.9	0.096	21
273.5	37.0	-41.3	0.7264	0.4771	0.2493	-6.7	0.066	17
261.3	38.0	-43.7	0.7372	0.4742	0.2630	-4.6	0.063	21
248.9	39.0	-46.3	0.7445	0.4767	0.2678	-2.9	0.044	17
236.9	40.0	-48.9	0.7476	0.4747	0.2728	-1.7	0.032	17
225.2	41.0	-51.7	0.7462	0.4722	0.2740	-1.3		A
213.8	42.0	-54.3	0.7428	0.4655	0.2773	-0.2		A
203.0	43.0	-56.8	0.7419	0.4632	0.2787	1.3		A
193.3	44.0	-58.8	0.7387	0.4665	0.2721	3.2		A
184.6	45.0	-60.3	0.7357	0.4699	0.2658	3.2		A
176.3	46.0	-61.9	0.7328	0.4747	0.2582	1.4		A
167.9	47.0	-63.9	0.7381	0.4763	0.2618	-1.5		A
160.1	48.0	-65.0	0.7443	0.4803	0.2646	-4.6		A
151.6	49.0	-65.4	0.7615	0.4882	0.2733	-6.3		A
143.7	50.0	-65.8	0.7760	0.4913	0.2847	-7.7		A
136.6	51.0	-66.8	0.7842	0.4902	0.2941	-8.9		A
130.0	52.0	-67.9	0.7904	0.4869	0.3035	-10.8		A
123.3	53.0	-68.7	0.7973	0.4794	0.3179	-10.9		A
116.7	54.0	-69.0	0.8072	0.4736	0.3336	-8.7		A
110.2	55.0	-68.3	0.8118	0.4705	0.3413	-3.1		A
104.0	56.0	-67.4	0.8162	0.4761	0.3401	2.9		A
99.0	57.0	-66.8	0.8185	0.4879	0.3306	6.4		A
94.5	58.0	-67.7	0.8257	0.5003	0.3253	5.5		A
90.0	59.0	-68.8	0.8317	0.5101	0.3216	3.9		A
85.3	60.0	-68.6	0.8342	0.5113	0.3229	4.6		A

80.9	61.0	-66.3	0.8270	0.5103	0.3167	6.6	A
76.8	62.0	-64.4	0.8216	0.5112	0.3105	9.0	A
73.0	63.0	-64.0	0.8195	0.5159	0.3038	8.0	A
68.9	64.0	-64.3	0.8162	0.5180	0.2982	6.9	A
63.9	65.0	-64.4	0.8100	0.5152	0.2948	6.4	A
58.4	66.0	-64.0	0.8067	0.5194	0.2874	6.5	A
52.0	67.0	-63.2	0.8023	0.5212	0.2811	7.1	A
45.8	68.0	-62.1	0.7960	0.5235	0.2725	9.6	A
40.8	69.0	-61.4	0.7916	0.5250	0.2666	12.7	A
37.8	70.0	-60.6	0.7815	0.5291	0.2524	15.8	A
35.0	71.0	-59.6	0.7706	0.5252	0.2454	15.0	A
32.2	72.0	-58.0	0.7600	0.5199	0.2401	10.7	A
29.5	73.0	-56.2	0.7541	0.5172	0.2368	12.0	A
27.2	74.0	-54.6	0.7492	0.5173	0.2319	16.7	A
24.9	75.0	-52.8	0.7424	0.5184	0.2240	24.0	A
22.8	76.0	-51.4	0.7414	0.5279	0.2135	28.1	A
20.6	77.0	-50.1	0.7430	0.5425	0.2006	35.8	A

1FILTERED RADIOMETERSONDE RUN FOR BUC 9 AUG 1973 OPUS 14

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1013.7	0.0	25.3	0.6747	0.6851	-0.0104	0.0	10.629	53
993.6	1.0	23.2	0.6834	0.6651	0.0183	-8.4	14.473	79
973.7	2.0	21.8	0.6771	0.6690	0.0082	-0.7	14.601	86
954.3	3.0	21.0	0.6772	0.6717	0.0055	0.9	13.004	80
933.6	4.0	20.6	0.6751	0.6679	0.0073	1.2	9.891	59
912.3	5.0	19.8	0.6669	0.6631	0.0039	2.1	10.165	63
891.0	6.0	18.0	0.6446	0.6563	-0.0117	2.5	9.452	64
871.2	7.0	16.5	0.6337	0.6554	-0.0217	2.1	8.688	65
851.6	8.0	15.3	0.6224	0.6461	-0.0238	1.2	8.161	62
832.3	9.0	14.2	0.6150	0.6400	-0.0250	1.0	8.705	71
814.2	10.0	12.7	0.6069	0.6360	-0.0291	1.4	7.488	66
797.9	11.0	11.5	0.5996	0.6344	-0.0348	1.8	7.189	67
781.7	12.0	10.4	0.5911	0.6311	-0.0400	1.9	6.807	67
765.2	13.0	9.3	0.5825	0.6276	-0.0451	1.7	6.302	66
749.2	14.0	8.2	0.5747	0.6243	-0.0496	1.1	5.498	60
733.7	15.0	6.9	0.5677	0.6206	-0.0529	0.5	5.215	61
718.2	16.0	5.7	0.5644	0.6153	-0.0509	0.2	5.852	73
703.1	17.0	4.9	0.5591	0.6103	-0.0512	0.3	5.552	71
688.9	18.0	4.2	0.5542	0.6073	-0.0531	0.5	5.164	68
675.0	19.0	3.2	0.5487	0.6047	-0.0560	0.2	4.733	66
661.0	20.0	2.0	0.5449	0.5992	-0.0542	0.0	4.441	66
646.9	21.0	0.9	0.5420	0.5949	-0.0529	0.3	4.130	65
633.2	22.0	-0.3	0.5365	0.5917	-0.0552	1.1	3.850	65
619.9	23.0	-1.3	0.5287	0.5873	-0.0586	1.6	3.643	65
606.9	24.0	-2.3	0.5166	0.5803	-0.0637	1.8	3.590	67
594.2	25.0	-3.2	0.5052	0.5715	-0.0663	1.7	3.635	71
582.0	26.0	-4.2	0.4947	0.5657	-0.0710	1.6	3.137	65
569.8	27.0	-5.3	0.4896	0.5622	-0.0727	1.8	2.760	61
557.1	28.0	-6.2	0.4845	0.5619	-0.0774	1.4	2.802	65
544.1	29.0	-6.8	0.4798	0.5616	-0.0818	1.0	2.970	69
530.5	30.0	-7.5	0.4778	0.5599	-0.0821	0.4	2.401	58
517.9	31.0	-8.6	0.4763	0.5573	-0.0810	0.8	2.222	57
506.6	32.0	-9.9	0.4710	0.5533	-0.0823	1.7	2.265	63
495.9	33.0	-11.0	0.4603	0.5498	-0.0895	2.3	1.820	54
483.9	34.0	-12.2	0.4524	0.5469	-0.0944	2.3	1.695	54
472.3	35.0	-13.5	0.4449	0.5422	-0.0973	1.5	1.454	51
461.8	36.0	-14.8	0.4367	0.5378	-0.1010	0.9	1.319	50
452.0	37.0	-16.3	0.4311	0.5317	-0.1005	0.0	1.227	51
441.8	38.0	-18.0	0.4292	0.5289	-0.0997	-0.6	1.084	51
432.3	39.0	-19.6	0.4288	0.5271	-0.0983	-0.8	0.956	50
424.0	40.0	-21.0	0.4294	0.5263	-0.0969	-0.8	0.788	46
417.0	41.0	-22.4	0.4275	0.5231	-0.0956	0.6	0.621	40
409.8	42.0	-23.7	0.4212	0.5172	-0.0960	2.6	0.457	33
402.1	43.0	-24.8	0.4111	0.5138	-0.1027	3.9	0.398	31
394.0	44.0	-25.7	0.4004	0.5105	-0.1101	3.9	0.379	31
386.0	45.0	-26.5	0.3914	0.5058	-0.1144	3.4	0.356	31
378.0	46.0	-27.4	0.3844	0.5009	-0.1165	3.7	0.338	31
370.0	47.0	-28.2	0.3764	0.4992	-0.1228	4.6	0.321	31
362.0	48.0	-29.0	0.3684	0.4991	-0.1307	5.8	0.302	31

1FILTERED RADIOMETERSONDE RUN FOR WSL 11 AUG 1973 OPUS 15

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
873.1	0.0	54.0	0.9341	0.8506	0.0835	0.0	13.011	42
841.7	1.0	26.7	0.9301	0.8146	0.1155	-5.9	11.511	44
810.5	2.0	23.3	0.9156	0.7836	0.1320	-2.2	10.319	46
779.4	3.0	19.5	0.9014	0.7549	0.1464	-2.0	8.733	48
749.6	4.0	15.8	0.8824	0.7296	0.1529	-1.3	7.696	51
720.6	5.0	13.0	0.8655	0.7085	0.1570	-0.8	7.130	54
693.3	6.0	10.2	0.8497	0.6914	0.1583	-0.4	6.524	57
666.4	7.0	7.2	0.8409	0.6790	0.1619	-0.4	5.793	60
641.9	8.0	4.7	0.8242	0.6641	0.1601	-1.1	5.242	64
619.5	9.0	3.2	0.8077	0.6421	0.1656	-2.3	4.945	63
599.2	10.0	2.1	0.7939	0.6148	0.1791	-3.3	4.720	63
578.9	11.0	0.4	0.7882	0.5929	0.1953	-3.0	2.477	36
559.0	12.0	-1.7	0.7835	0.5816	0.2020	-2.3	2.185	36
538.9	13.0	-4.1	0.7776	0.5712	0.2063	-2.1	1.745	33
519.2	14.0	-6.1	0.7726	0.5593	0.2133	-2.4	1.515	33
499.8	15.0	-7.5	0.7699	0.5454	0.2245	-2.3	1.432	32
481.3	16.0	-8.7	0.7697	0.5375	0.2322	-1.7	1.335	32
462.7	17.0	-10.7	0.7676	0.5333	0.2343	-1.0	1.188	32
444.3	18.0	-13.3	0.7621	0.5263	0.2357	-1.2	1.033	33
425.9	19.0	-16.2	0.7536	0.5154	0.2383	-2.1	0.819	32
407.8	20.0	-19.0	0.7512	0.5028	0.2484	-3.1	0.679	32
390.3	21.0	-21.5	0.7505	0.4897	0.2608	-3.3	0.575	32
373.8	22.0	-23.9	0.7479	0.4772	0.2707	-2.7	0.483	32
358.1	23.0	-26.2	0.7435	0.4683	0.2752	-1.6	0.409	32
341.7	24.0	-28.6	0.7399	0.4616	0.2783	-1.1	0.350	32
325.5	25.0	-31.1	0.7357	0.4572	0.2785	-1.4	0.282	32
309.5	26.0	-33.3	0.7333	0.4489	0.2844	-1.6	0.242	32
294.4	27.0	-35.4	0.7311	0.4394	0.2906	-1.7	0.213	32
279.7	28.0	-37.8	0.7236	0.4301	0.2935	-1.5	0.171	32
266.2	29.0	-40.5	0.7204	0.4253	0.2952	-1.7	0.137	32
252.9	30.0	-43.3	0.7206	0.4205	0.3001	-1.8	0.108	32
239.9	31.0	-46.2	0.7206	0.4142	0.3065	-2.0	0.083	32
227.3	32.0	-49.3	0.7192	0.4110	0.3083	-1.5	0.062	32
214.6	33.0	-52.0	0.7201	0.4077	0.3124	-0.9		A
202.5	34.0	-54.5	0.7163	0.4036	0.3128	-0.5		A
190.6	35.0	-57.0	0.7113	0.3973	0.3140	-0.3		A
179.2	36.0	-59.3	0.7039	0.3913	0.3126	-0.8		A
168.0	37.0	-61.6	0.7019	0.3859	0.3160	-1.8		A
158.1	38.0	-64.0	0.7029	0.3839	0.3189	-2.5		A
148.9	39.0	-66.3	0.7086	0.3819	0.3267	-1.9		A
140.0	40.0	-68.2	0.7096	0.3819	0.3278	-0.3		A
131.0	41.0	-69.4	0.7050	0.3784	0.3267	0.2		A
121.8	42.0	-68.8	0.6953	0.3703	0.3249	0.3		A
113.3	43.0	-67.8	0.6890	0.3624	0.3266	0.5		A
106.1	44.0	-67.4	0.6860	0.3604	0.3255	0.0		A
99.4	45.0	-66.9	0.6857	0.3628	0.3228	-0.7		A
92.6	46.0	-65.2	0.6882	0.3615	0.3267	-1.8		A
85.9	47.0	-63.5	0.6928	0.3626	0.3302	-1.6		A
79.9	48.0	-62.2	0.6959	0.3638	0.3321	0.0		A
74.3	49.0	-62.0	0.6961	0.3672	0.3289	0.9		A
69.2	50.0	-61.7	0.6957	0.3687	0.3271	0.3		A
64.3	51.0	-61.5	0.6950	0.3666	0.3284	-1.8		A
59.8	52.0	-59.7	0.6911	0.3599	0.3312	-3.3		A
55.6	53.0	-57.7	0.6877	0.3538	0.3339	-4.6		A
51.7	54.0	-55.8	0.6843	0.3478	0.3365	-6.4		A
48.3	55.0	-54.4	0.6847	0.3432	0.3415	-7.9		A
45.3	56.0	-52.7	0.6851	0.3380	0.3472	-6.8		A
42.6	57.0	-51.5	0.6848	0.3343	0.3505	-3.7		A
39.9	58.0	-50.5	0.6816	0.3324	0.3491	-1.2		A
37.3	59.0	-49.7	0.6822	0.3330	0.3492	-2.2		A
35.0	60.0	-49.2	0.6871	0.3367	0.3505	-6.7		A

32.8	61.0	-49.3	0.6957	0.3413	0.3543	-10.5	A
30.5	62.0	-49.3	0.7007	0.3411	0.3597	-11.1	A
28.2	63.0	-49.7	0.7063	0.3413	0.3651	-8.2	A
26.2	64.0	-49.9	0.7066	0.3405	0.3660	-3.0	A
24.6	65.0	-49.5	0.7059	0.3402	0.3656	3.3	A
23.0	66.0	-48.3	0.7037	0.3396	0.3641	8.0	A
21.3	67.0	-46.4	0.6999	0.3386	0.3613	10.3	A
20.0	67.8	-44.3	0.6956	0.3375	0.3580	14.2	A

1FILTERED RADIOMETERSONDE RUN FOR WSL 11 AUG 1973 OPUS 16

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
873.7	0.0	40.0	0.7842	0.7111	0.0731	0.0	16.029	47
850.0	1.0	27.5	0.8344	0.7071	0.1273	-13.4	8.491	33
826.1	2.0	24.1	0.8193	0.7016	0.1177	2.9	7.930	34
801.2	3.0	21.7	0.8006	0.6877	0.1129	1.1	7.382	36
778.7	4.0	18.8	0.7825	0.6728	0.1096	0.5	7.667	44
758.5	5.0	16.6	0.7667	0.6576	0.1091	-0.6	7.170	46
739.9	6.0	15.1	0.7583	0.6471	0.1112	-1.5	7.055	48
723.8	7.0	13.7	0.7507	0.6293	0.1213	-1.8	6.684	49
709.0	8.0	11.6	0.7399	0.6139	0.1260	-1.5	6.290	51
690.1	9.0	9.3	0.7305	0.6027	0.1278	-1.4	5.601	53
667.6	10.0	6.8	0.7204	0.5904	0.1300	-2.2	5.183	55
644.1	11.0	4.3	0.7173	0.5741	0.1432	-3.2	4.767	59
621.7	12.0	1.7	0.7084	0.5492	0.1592	-4.1	4.379	63
600.6	13.0	-0.3	0.6995	0.5241	0.1754	-4.4	4.131	66
580.6	14.0	-2.0	0.6890	0.4989	0.1902	-4.5	3.595	62
561.1	15.0	-4.0	0.6808	0.4763	0.2045	-5.0	3.472	68
540.8	16.0	-6.3	0.6747	0.4538	0.2209	-5.6	2.950	66
521.3	17.0	-8.2	0.6693	0.4259	0.2434	-5.8	2.049	52
502.7	18.0	-9.5	0.6653	0.4019	0.2634	-5.4	1.222	33
485.3	19.0	-10.1	0.6584	0.3819	0.2765	-3.1	1.101	30
467.6	20.0	-11.2	0.6516	0.3642	0.2874	-1.4	1.035	29
450.2	21.0	-13.2	0.6299	0.3512	0.2787	-1.5	0.906	29
434.3	22.0	-15.4	0.6252	0.3424	0.2828	-4.5	0.748	28
420.7	23.0	-17.5	0.6335	0.3337	0.2998	-6.4	0.666	28
408.2	24.0	-19.8	0.6592	0.3251	0.3341	-5.7	0.568	28
395.9	25.0	-21.6	0.6436	0.3177	0.3259	-3.3	0.479	29
384.2	26.0	-23.1	0.6422	0.3116	0.3306	-1.4	0.466	29
371.7	27.0	-24.8	0.6423	0.3064	0.3359	-2.3	0.406	29
357.7	28.0	-27.0	0.6420	0.2978	0.3442	3.1	0.354	30
343.8	29.0	-29.2	0.6302	0.2853	0.3448	14.0	0.315	31
330.3	30.0	-31.3	0.5737	0.2826	0.2911	25.3	0.245	29
317.2	31.0	-33.5	0.4845	0.2851	0.1994	28.3	0.214	29
304.3	32.0	-35.4	0.4119	0.2834	0.1285	20.0	0.183	29
292.8	33.0	-37.2	0.4001	0.2795	0.1205	8.0	0.166	30
282.0	34.0	-39.0	0.4046	0.2820	0.1226	-0.9	0.143	30
271.0	35.0	-40.8	0.4056	0.2807	0.1249	-2.7	0.123	30
259.8	36.0	-42.8	0.4059	0.2713	0.1346	-2.1	0.108	30
249.4	37.0	-44.9	0.4025	0.2630	0.1395	0.2	0.085	30
239.7	38.0	-47.3	0.3931	0.2590	0.1342	3.5	0.073	31
230.0	39.0	-48.7	0.3792	0.2556	0.1236	4.2	0.057	30
220.3	40.0	-50.6	0.3680	0.2550	0.1130	1.0	0.057	30
210.7	41.0	-52.6	0.3654	0.2495	0.1159	-3.1		A
200.9	42.0	-55.1	0.3719	0.2425	0.1294	-6.5		A
191.3	43.0	-57.1	0.3760	0.2347	0.1412	-6.4		A
183.1	44.0	-59.4	0.3769	0.2245	0.1523	-4.7		A
175.7	45.0	-61.5	0.3734	0.2213	0.1521	-3.6		A
168.3	46.0	-63.1	0.3713	0.2148	0.1564	-2.6		A
160.5	47.0	-64.4	0.3724	0.2105	0.1619	-2.8		A
153.7	48.0	-65.6	0.3760	0.2118	0.1642	-2.5		A
147.6	49.0	-66.8	0.3774	0.2125	0.1649	-2.0		A
142.2	50.0	-68.2	0.3760	0.2072	0.1688	-1.6		A
135.7	51.0	-69.2	0.3701	0.2004	0.1697	-1.8		A
129.2	52.0	-69.9	0.3615	0.1917	0.1698	-2.9		A
123.1	53.0	-70.8	0.3594	0.1853	0.1741	-5.5		A
118.0	54.0	-71.6	0.3640	0.1821	0.1819	-10.2		A
112.8	55.0	-71.4	0.3700	0.1796	0.1904	-15.9		A
107.0	56.0	-70.5	0.3835	0.1753	0.2083	-21.8		A
101.2	57.0	-69.6	0.4032	0.1681	0.2351	-25.4		A
96.0	58.0	-68.4	0.4235	0.1604	0.2630	-25.1		A
91.3	59.0	-67.0	0.4348	0.1549	0.2799	-20.1		A
87.0	60.0	-66.1	0.4432	0.1508	0.2924	-11.9		A

83.0	61.0	-66.0	0.4461	0.1489	0.2971	-4.6	A
79.1	62.0	-65.6	0.4446	0.1473	0.2973	2.0	A
74.9	63.0	-64.9	0.4436	0.1501	0.2934	4.7	A
71.0	64.0	-64.6	0.4443	0.1570	0.2674	2.2	A
67.3	65.0	-64.6	0.4503	0.1641	0.2862	-5.1	A
63.7	66.0	-62.8	0.4552	0.1614	0.2937	-15.1	A
60.5	67.0	-60.7	0.4641	0.1582	0.3059	-23.7	A
57.4	68.0	-59.6	0.4764	0.1554	0.3210	-25.1	A
54.6	69.0	-59.4	0.4896	0.1535	0.3361	-22.8	A
52.0	70.0	-58.1	0.4967	0.1554	0.3413	-19.8	A
49.4	71.0	-57.0	0.5083	0.1594	0.3489	-22.6	A
46.9	72.0	-56.2	0.5200	0.1610	0.3590	-34.5	A
44.7	73.0	-55.4	0.5339	0.1585	0.3753	-44.7	A
42.7	74.0	-54.5	0.5491	0.1527	0.3964	-43.7	A
40.7	75.0	-53.8	0.5595	0.1476	0.4119	-26.7	A
38.8	76.0	-53.3	0.5609	0.1458	0.4151	-7.9	A
37.0	77.0	-52.7	0.5552	0.1454	0.4098	3.4	A
35.1	78.0	-52.8	0.5582	0.1479	0.4102	5.1	A
33.2	79.0	-53.2	0.5623	0.1535	0.4088	0.9	A
31.4	80.0	-53.1	0.5669	0.1594	0.4074	-6.0	A
29.7	81.0	-52.5	0.5733	0.1635	0.4098	-20.0	A
28.0	82.0	-52.4	0.5847	0.1660	0.4187	-36.2	A
26.4	83.0	-52.1	0.5984	0.1664	0.4320	-53.0	A
25.1	84.0	-51.5	0.6108	0.1649	0.4459	-68.0	A
23.8	85.0	-50.5	0.6250	0.1630	0.4620	-75.6	A
22.6	86.0	-49.7	0.6414	0.1607	0.4806	-72.6	A
21.2	87.0	-48.7	0.6554	0.1584	0.4970	-56.1	A
20.0	88.0	-48.1	0.6672	0.1604	0.5068	-34.0	A
19.0	89.0	-47.6	0.6751	0.1670	0.5081	-29.5	A
18.1	90.0	-46.7	0.6825	0.1750	0.5074	-57.7	A
17.2	91.0	-45.7	0.6969	0.1754	0.5215	-93.7	A
16.3	92.0	-45.1	0.7179	0.1727	0.5452	-88.0	A
15.5	93.0	-44.6	0.7303	0.1694	0.5609	-14.0	A
14.6	94.0	-43.6	0.7219	0.1699	0.5521	59.8	A
14.1	94.6	-42.9	0.7104	0.1708	0.5397	140.2	A

1FILTERED RADIOMETERSONDE RUN FOR WSL 12 AUG 1973 OPUS 17

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
879.5	1.0	27.0	0.6618	0.6372	0.0246	0.0	13.956	62
817.8	2.0	19.0	0.7338	0.6247	0.1090	-8.0	9.728	58
786.9	3.0	16.7	0.7209	0.6176	0.1032	-0.3	8.972	58
754.8	4.0	14.9	0.7089	0.6062	0.1027	-0.9	7.951	56
725.9	5.0	12.5	0.7041	0.5899	0.1142	-1.9	6.922	54
699.7	6.0	10.0	0.7025	0.5752	0.1272	-2.4	6.363	58
674.1	7.0	7.6	0.6993	0.5623	0.1370	-2.4	5.459	56
649.0	8.0	5.5	0.6946	0.5496	0.1450	-2.4	4.333	49
625.0	9.0	3.7	0.6916	0.5352	0.1563	-2.4	3.245	41
602.1	10.0	2.1	0.6880	0.5207	0.1673	-2.2	2.593	35
579.9	11.0	0.2	0.6853	0.5110	0.1744	-1.7	2.406	35
558.1	12.0	-2.0	0.6847	0.5061	0.1785	-1.3	2.527	43
535.6	13.0	-4.1	0.6840	0.5008	0.1832	-1.2	2.536	48
513.5	14.0	-5.9	0.6801	0.4933	0.1867	-1.5	2.089	43
492.8	15.0	-7.7	0.6741	0.4822	0.1919	-2.1	2.007	46
474.2	16.0	-9.7	0.6684	0.4680	0.2003	-3.2	1.381	35
455.4	17.0	-11.7	0.6658	0.4539	0.2120	-4.2	1.224	35
437.9	18.0	-13.6	0.6690	0.4410	0.2280	-4.6	1.105	36
421.5	19.0	-15.6	0.6711	0.4283	0.2428	-3.8	1.021	37
406.1	20.0	-17.5	0.6694	0.4183	0.2511	-2.3	0.909	38
390.0	21.0	-19.5	0.6639	0.4112	0.2527	-1.4	0.709	34
373.8	22.0	-21.5	0.6563	0.4024	0.2539	-1.9	0.531	28
358.3	23.0	-24.0	0.6503	0.3893	0.2610	-2.8	0.434	28
343.8	24.0	-26.7	0.6485	0.3766	0.2719	-3.3	0.365	29
330.0	25.0	-29.2	0.6499	0.3709	0.2790	-2.9	0.295	28
315.8	26.0	-31.4	0.6514	0.3662	0.2852	-2.1	0.256	29
302.4	27.0	-33.5	0.6508	0.3614	0.2894	-1.0	0.216	28
289.7	28.0	-35.8	0.6490	0.3586	0.2904	-0.0	0.181	29
276.9	29.0	-38.1	0.6452	0.3574	0.2878	0.6	0.151	29
264.5	30.0	-40.6	0.6427	0.3562	0.2864	0.8	0.126	29
252.5	31.0	-43.2	0.6396	0.3547	0.2849	0.9	0.101	30
239.9	32.0	-45.7	0.6378	0.3542	0.2836	0.9	0.080	29
227.6	33.0	-47.9	0.6337	0.3537	0.2800	-0.1	0.066	30
216.5	34.0	-50.1	0.6311	0.3516	0.2795	-2.1	0.056	30
206.3	35.0	-52.3	0.6301	0.3424	0.2877	-4.5		A
196.0	36.0	-54.3	0.6290	0.3300	0.2990	-4.5		A
185.7	37.0	-55.9	0.6270	0.3173	0.3097	-1.9		A
175.4	38.0	-57.6	0.6255	0.3169	0.3086	1.8		A
165.7	39.0	-60.1	0.6253	0.3257	0.2996	4.4		A
157.4	40.0	-62.6	0.6233	0.3339	0.2894	4.1		A
149.7	41.0	-64.8	0.6200	0.3343	0.2858	1.7		A
142.0	42.0	-66.5	0.6161	0.3292	0.2869	-0.3		A
134.3	43.0	-68.2	0.6152	0.3259	0.2892	-0.5		A
126.7	44.0	-69.5	0.6171	0.3275	0.2896	-0.2		A
119.1	45.0	-70.0	0.6192	0.3315	0.2877	-0.3		A
110.8	46.0	-69.6	0.6225	0.3338	0.2887	-1.5		A
103.5	47.0	-68.9	0.6243	0.3326	0.2918	-3.0		A
97.6	48.0	-67.9	0.6266	0.3297	0.2969	-3.7		A
93.1	49.0	-66.8	0.6268	0.3266	0.3002	-3.0		A
88.9	50.0	-65.5	0.6250	0.3233	0.3017	-2.0		A
85.1	51.0	-64.5	0.6230	0.3222	0.3008	-4.0		A
81.2	52.0	-64.0	0.6262	0.3226	0.3036	-7.7		A
77.2	53.0	-63.7	0.6360	0.3236	0.3124	-9.1		A
73.4	54.0	-61.9	0.6443	0.3228	0.3215	-4.6		A
69.6	55.0	-59.5	0.6477	0.3259	0.3218	3.7		A
66.0	56.0	-58.0	0.6490	0.3353	0.3137	8.8		A
62.3	57.0	-57.8	0.6518	0.3472	0.3046	6.9		A
58.8	58.0	-57.7	0.6535	0.3506	0.3029	-0.1		A
55.2	59.0	-56.9	0.6557	0.3497	0.3060	-6.2		A
51.7	60.0	-55.6	0.6586	0.3452	0.3134	-5.4		A
48.5	61.0	-54.6	0.6633	0.3459	0.3174	-0.5		A

45.6	62.0	-54.3	0.6691	0.3567	0.3124	3.1	A
42.4	63.0	-54.4	0.6727	0.3649	0.3078	3.1	A
40.3	64.0	-54.1	0.6719	0.3615	0.3104	0.6	A
37.6	65.0	-53.6	0.6700	0.3584	0.3116	1.4	A
34.7	66.0	-53.7	0.6735	0.3644	0.3091	6.4	A
31.5	67.0	-53.6	0.6784	0.3733	0.3051	10.5	A
29.5	68.0	-52.3	0.6772	0.3784	0.2989	15.9	A
27.2	69.0	-50.0	0.6678	0.3755	0.2922	17.5	A
25.2	70.0	-48.5	0.6621	0.3767	0.2854	13.4	A
23.8	71.0	-47.8	0.6640	0.3819	0.2821	-2.5	A
22.7	72.0	-47.1	0.6707	0.3861	0.2847	-26.1	A
21.4	73.0	-45.5	0.6788	0.3832	0.2955	-35.5	A
20.2	74.0	-43.9	0.6823	0.3763	0.3060	-21.9	A
19.1	75.0	-42.9	0.6790	0.3711	0.3080	2.9	A
17.9	76.0	-42.6	0.6717	0.3711	0.3006	14.9	A
16.7	77.0	-42.2	0.6679	0.3726	0.2953	12.6	A
15.5	78.0	-41.8	0.6729	0.3758	0.2970	-1.9	A
14.2	79.0	-[illegible]2.1	0.6789	0.3821	0.2968	-15.0	A
13.0	80.0	-43.0	0.6889	0.3871	0.3018	-12.9	A
11.9	81.0	-43.4	0.6978	0.3896	0.3082	1.5	A
10.9	82.0	-42.7	0.6977	0.3939	0.3038	25.2	A
10.0	82.9	-41.2	0.6927	0.3972	0.2955	58.1	A

1FILTERED RADIOMETERSONDE RUN FOR WSD 11 AUG 1973 OPUS 18

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
878.1	0.0	47.0	1.8567	0.8908	-0.0341	0.0	14.893	34
839.6	1.0	30.3	1.3574	0.8821	0.4753	-77.8	15.730	50
806.0	2.0	25.4	1.3286	0.8497	0.4789	-0.3	13.439	51
777.6	3.0	21.6	1.2792	0.8193	0.4599	3.4	10.157	50
753.6	4.0	18.4	1.2426	0.8044	0.4382	4.6	9.105	51
730.8	5.0	16.1	1.2473	0.8296	0.4177	3.5	8.208	52
707.0	6.0	13.7	1.2261	0.8207	0.4054	0.0	7.455	53
683.2	7.0	11.1	1.2018	0.7957	0.4061	-2.9	6.843	56
659.0	8.0	8.9	1.2061	0.7629	0.4432	-5.1	6.151	57
640.3	9.0	7.4	1.2299	0.7741	0.4558	-3.4	5.874	58
620.1	10.0	5.9	1.2368	0.7651	0.4717	0.8	5.385	56
599.8	11.0	3.7	1.1908	0.7389	0.4519	3.0	4.518	55
577.4	12.0	1.2	1.1363	0.7059	0.4304	2.9	3.867	53
559.5	13.0	-1.0	1.1114	0.6863	0.4252	0.3	3.419	54
539.6	14.0	-3.2	1.1059	0.6705	0.4354	-2.0	2.851	50
520.3	15.0	-5.1	1.1014	0.6572	0.4443	-2.3	2.493	49
502.3	16.0	-6.3	1.0925	0.6392	0.4532	-1.4	1.873	40
485.4	17.0	-7.2	1.0726	0.6209	0.4518	-0.4	1.704	36
468.3	18.0	-8.7	1.0600	0.6069	0.4530	0.4	1.516	36
450.9	19.0	-11.1	1.0521	0.6011	0.4510	-0.1	1.326	36
433.9	20.0	-13.3	1.0425	0.5941	0.4484	-0.9	1.112	35
417.2	21.0	-15.4	1.0397	0.5844	0.4553	-1.6	0.985	35
400.7	22.0	-17.6	1.0341	0.5707	0.4635	-1.8	0.838	35
385.4	23.0	-19.9	1.0241	0.5587	0.4654	-0.8	0.727	35
370.6	24.0	-22.0	1.0128	0.5448	0.4679	0.8	0.628	35
356.3	25.0	-24.2	0.9996	0.5362	0.4634	2.8	0.549	35
341.7	26.0	-26.3	0.9871	0.5325	0.4546	4.4	0.439	34
328.4	27.0	-28.4	0.9701	0.5325	0.4375	4.8	0.402	35
315.5	28.0	-30.4	0.9583	0.5290	0.4293	4.2	0.343	35
303.5	29.0	-32.4	0.9451	0.5233	0.4219	2.2	0.291	35
291.6	30.0	-34.2	0.9331	0.5149	0.4181	0.2	0.262	35
280.3	31.0	-35.9	0.9223	0.5018	0.4205	-0.7	0.221	35
268.8	32.0	-38.1	0.9132	0.4855	0.4277	-0.2	0.191	35
256.8	33.0	-40.4	0.9002	0.4761	0.4240	1.1	0.152	34
244.1	34.0	-43.3	0.8934	0.4745	0.4188	1.6	0.121	34
232.3	35.0	-46.1	0.8880	0.4741	0.4138	0.9	0.092	34
221.6	36.0	-48.8	0.8797	0.4635	0.4162	0.2	0.072	34
211.1	37.0	-51.2	0.8703	0.4537	0.4165	0.5		A
201.3	38.0	-53.2	0.8624	0.4470	0.4154	1.0		A
192.9	39.0	-55.2	0.8558	0.4453	0.4104	0.5		A
184.8	40.0	-57.1	0.8524	0.4407	0.4117	-0.6		A
176.1	41.0	-59.2	0.8515	0.4368	0.4147	-1.4		A
166.9	42.0	-61.2	0.8475	0.4296	0.4179	-0.2		A
158.3	43.0	-63.0	0.8430	0.4253	0.4176	1.4		A
149.7	44.0	-64.9	0.8399	0.4276	0.4120	2.4		A
141.2	45.0	-67.2	0.8412	0.4339	0.4073	2.0		A
133.0	46.0	-69.2	0.8429	0.4368	0.4061	0.5		A
126.3	47.0	-70.2	0.8430	0.4359	0.4070	-1.4		A
119.5	48.0	-70.7	0.8432	0.4344	0.4088	-2.9		A
112.1	49.0	-70.4	0.8408	0.4266	0.4142	-3.8		A
105.5	50.0	-68.3	0.8337	0.4138	0.4198	-3.8		A
100.9	51.0	-66.6	0.8266	0.4038	0.4227	-2.8		A
96.0	52.0	-66.5	0.8213	0.3979	0.4234	-2.2		A
89.9	53.0	-66.8	0.8195	0.3945	0.4250	-2.4		A
84.1	54.0	-65.6	0.8172	0.3884	0.4288	-0.9		A
79.5	55.0	-64.6	0.8149	0.3835	0.4315	2.8		A
75.1	56.0	-63.8	0.8114	0.3873	0.4241	7.3		A
71.0	57.0	-62.9	0.8084	0.3918	0.4166	10.8		A
67.2	58.0	-62.2	0.8070	0.3970	0.4100	11.0		A
63.6	59.0	-62.0	0.8060	0.4041	0.4019	9.1		A
59.9	60.0	-61.4	0.8035	0.4072	0.3963	5.6		A

56.5	61.0	-60.2	0.8000	0.4046	0.3955	1.9	A
53.3	62.0	-58.5	0.7939	0.3973	0.3966	-1.1	A
50.4	63.0	-57.2	0.7875	0.3910	0.3965	-4.5	A
47.3	64.0	-55.8	0.7836	0.3849	0.3987	-8.6	A
44.4	65.0	-54.6	0.7345	0.3787	0.4058	-13.5	A
41.9	66.0	-53.9	0.7847	0.3715	0.4132	-13.6	A
39.7	67.0	-53.8	0.7850	0.3650	0.4200	-5.2	A
37.5	68.0	-53.3	0.7828	0.3630	0.4197	8.6	A
35.4	69.0	-52.0	0.7813	0.3638	0.4125	18.7	A
33.1	70.0	-50.2	0.7790	0.3779	0.4012	17.9	A
31.0	71.0	-49.1	0.7777	0.3830	0.3947	8.6	A
29.1	72.0	-49.0	0.7750	0.3790	0.3959	-2.0	A
27.4	73.0	-49.2	0.7713	0.3707	0.4006	-7.0	A
25.9	74.0	-49.0	0.7689	0.3677	0.4012	-8.6	A
24.4	75.0	-48.7	0.7704	0.3687	0.4017	-11.6	A
22.8	76.0	-46.8	0.7757	0.3690	0.4067	-16.1	A
21.3	77.0	-49.3	0.7841	0.3708	0.4133	-14.1	A
19.9	78.0	-49.5	0.7886	0.3726	0.4160	-5.4	A
18.7	79.0	-49.1	0.7869	0.3728	0.4141	2.3	A
17.4	80.0	-47.7	0.7831	0.3706	0.4125	0.7	A
16.2	81.0	-45.6	0.7800	0.3674	0.4126	-5.8	A
15.1	82.0	-43.9	0.7798	0.3639	0.4160	-10.4	A
14.2	83.0	-42.5	0.7792	0.3612	0.4180	-7.0	A
13.5	84.0	-40.8	0.7761	0.3578	0.4183	1.0	A
12.8	85.0	-39.0	0.7702	0.3538	0.4164	2.9	A
12.1	86.0	-37.9	0.7668	0.3507	0.4161	4.0	A
11.4	87.0	-37.2	0.7654	0.3480	0.4173	8.2	A
10.7	88.0	-36.5	0.7627	0.3473	0.4154	17.0	A
10.0	89.1	-35.9	0.7593	0.3477	0.4116	30.7	A

1FILTERED RADIOMETERSONDE RUN FOR WSD 11 AUG 1973 OPUS 19

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
877.3	0.0	36.0	0.7448	0.6752	0.0696	0.0	5.140	13
851.1	1.0	30.6	0.7534	0.6812	0.0722	-0.5	8.424	26
826.9	2.0	27.3	0.7372	0.6807	0.0565	-0.5	9.571	35
805.1	3.0	25.2	0.7404	0.6748	0.0656	-2.7	8.861	35
784.5	4.0	23.1	0.7553	0.6654	0.0899	-4.2	8.582	38
763.8	5.0	20.9	0.7567	0.6514	0.1053	-3.4	8.303	41
744.0	6.0	18.8	0.7498	0.6397	0.1101	-2.0	8.106	44
724.0	7.0	16.8	0.7413	0.6260	0.1153	-1.4	7.914	48
704.3	8.0	14.9	0.7311	0.6123	0.1188	-1.5	7.670	51
683.6	9.0	12.9	0.7192	0.5938	0.1254	-1.3	7.155	52
661.2	10.0	10.6	0.7100	0.5788	0.1312	-1.2	6.458	53
636.9	11.0	7.7	0.6998	0.5669	0.1329	-1.4	5.675	54
611.8	12.0	4.8	0.6939	0.5548	0.1391	-2.5	5.401	61
587.4	13.0	2.2	0.6876	0.5366	0.1511	-3.7	4.749	61
564.7	14.0	0.4	0.6832	0.5089	0.1743	-4.7	4.434	64
544.5	15.0	-1.4	0.6697	0.4821	0.1876	-5.3	3.509	54
525.6	16.0	-3.3	0.6585	0.4512	0.2074	-5.6	2.424	42
506.9	17.0	-5.2	0.6492	0.4252	0.2240	-5.6	1.400	27
488.3	18.0	-6.5	0.6491	0.4018	0.2473	-4.5	0.919	19
470.7	19.0	-7.6	0.6431	0.3877	0.2553	-3.8	0.889	19
454.2	20.0	-9.1	0.6383	0.3781	0.2602	-3.1	0.813	19
437.8	21.0	-11.3	0.6369	0.3639	0.2730	-2.9	0.720	19
422.1	22.0	-13.2	0.6313	0.3491	0.2823	-2.2	0.627	19
407.1	23.0	-15.5	0.6252	0.3408	0.2844	-0.9	0.579	20
393.0	24.0	-17.9	0.6169	0.3343	0.2826	-0.9	0.460	20
378.7	25.0	-20.5	0.6116	0.3272	0.2844	-1.6	0.404	20
364.3	26.0	-22.5	0.6043	0.3105	0.2938	-2.2	0.347	20
349.6	27.0	-24.7	0.5997	0.3010	0.2988	-1.9	0.303	20
335.4	28.0	-27.0	0.5976	0.2946	0.3030	-1.6	0.258	20
321.7	29.0	-29.5	0.5909	0.2876	0.3033	-2.2	0.214	21
309.4	30.0	-31.6	0.5845	0.2736	0.3109	-3.3	0.182	21
297.7	31.0	-33.3	0.5776	0.2584	0.3191	-3.9	0.166	21
286.0	32.0	-35.1	0.5760	0.2467	0.3293	-2.6	0.144	21
274.2	33.0	-37.2	0.5738	0.2402	0.3335	-0.6	0.123	21
262.9	34.0	-39.3	0.5712	0.2417	0.3295	0.5	0.104	21
252.0	35.0	-41.5	0.5684	0.2437	0.3246	-0.7	0.087	21
240.9	36.0	-43.6	0.5666	0.2379	0.3287	-3.1	0.073	21
230.2	37.0	-46.1	0.5689	0.2284	0.3405	-4.3	0.060	22
219.9	38.0	-47.8	0.5707	0.2209	0.3499	-3.1	0.049	22
209.9	39.0	-49.9	0.5741	0.2215	0.3524	-1.1	0.046	22
200.1	40.0	-52.3	0.5760	0.2265	0.3495	-0.8		A
191.2	41.0	-54.8	0.5756	0.2261	0.3495	-2.9		A
182.7	42.0	-56.4	0.5756	0.2178	0.3578	-5.0		A
174.3	43.0	-58.1	0.5798	0.2099	0.3699	-5.8		A
165.9	44.0	-60.0	0.5842	0.2091	0.3751	-4.8		A
158.0	45.0	-62.3	0.5879	0.2058	0.3820	-2.9		A
149.8	46.0	-64.1	0.5853	0.2000	0.3853	-1.9		A
142.5	47.0	-65.8	0.5822	0.1978	0.3845	-1.5		A
135.4	48.0	-67.1	0.5786	0.1926	0.3860	-2.9		A
128.3	49.0	-68.3	0.5773	0.1865	0.3908	-5.2		A
120.8	50.0	-69.5	0.5792	0.1792	0.4001	-6.8		A
114.1	51.0	-69.9	0.5811	0.1723	0.4088	-6.5		A
108.1	52.0	-69.2	0.5847	0.1673	0.4174	-3.6		A
103.1	53.0	-67.7	0.5829	0.1657	0.4172	1.6		A
98.1	54.0	-67.5	0.5818	0.1687	0.4130	4.9		A
91.9	55.0	-67.6	0.5714	0.1678	0.4035	4.5		A
86.5	56.0	-66.9	0.5619	0.1610	0.4010	0.6		A
82.3	57.0	-65.1	0.5552	0.1523	0.4029	-5.9		A
78.7	58.0	-63.9	0.5575	0.1468	0.4107	-9.3		A
74.1	59.0	-63.0	0.5636	0.1433	0.4203	-7.5		A
69.8	60.0	-62.0	0.5662	0.1420	0.4243	-3.4		A

66.0	61.0	-61.3	0.5636	0.1402	0.4235	0.5	A
62.6	62.0	-60.5	0.5587	0.1381	0.4206	2.8	A
59.3	63.0	-59.6	0.5564	0.1358	0.4207	5.3	A
56.1	64.0	-58.7	0.5532	0.1356	0.4176	9.0	A
53.1	65.0	-57.8	0.5485	0.1381	0.4105	11.9	A
50.4	66.0	-56.2	0.5407	0.1385	0.4022	9.4	A
47.8	67.0	-54.7	0.5339	0.1347	0.3992	2.8	A
45.1	68.0	-53.5	0.5302	0.1285	0.4017	-1.7	A
42.6	69.0	-53.0	0.5285	0.1241	0.4043	-1.7	A
40.2	70.0	-52.4	0.5258	0.1224	0.4034	1.6	A
37.9	71.0	-51.6	0.5231	0.1211	0.4020	3.7	A
36.0	71.9	-50.9	0.5204	0.1203	0.4001	5.7	A

1FILTERED RADIOMETERSONDE RUN FOR WSD 11 AUG 1973 OPUS 20

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
879.6	0.0	23.0	0.6272	0.6221	0.0051	0.0	10.385	58
853.6	1.0	20.7	0.9281	0.6030	0.3250	-72.3	10.377	57
827.6	2.0	19.7	0.9240	0.6007	0.3233	-1.8	10.191	58
801.8	3.0	18.1	0.9200	0.5993	0.3207	-0.2	9.744	60
776.0	4.0	16.4	0.9172	0.5968	0.3204	-1.1	9.279	60
750.7	5.0	14.5	0.9199	0.5883	0.3317	-1.6	8.169	59
726.6	6.0	12.3	0.9200	0.5787	0.3414	-1.5	7.247	58
702.5	7.0	10.1	0.9154	0.5702	0.3452	-1.3	6.526	58
679.9	8.0	7.9	0.9081	0.5636	0.3446	-1.9	5.774	59
658.9	9.0	5.6	0.9053	0.5497	0.3557	-2.7	4.822	55
638.0	10.0	3.9	0.9051	0.5325	0.3727	-2.9	4.508	57
616.0	11.0	2.7	0.9012	0.5214	0.3797	-2.2	3.315	43
599.9	12.0	1.5	0.8979	0.5144	0.3835	-1.1	2.887	40
581.1	13.0	-0.0	0.8934	0.5082	0.3852	-1.1	2.616	40
560.1	14.0	-1.7	0.8899	0.5011	0.3888	-1.2	2.626	43
537.0	15.0	-3.3	0.8856	0.4900	0.3956	-1.2	2.389	43
519.7	16.0	-4.9	0.8805	0.4816	0.3989	-0.9	2.183	42
501.3	17.0	-6.5	0.8750	0.4744	0.4006	-0.4	1.866	40
484.3	18.0	-8.5	0.8669	0.4671	0.3998	-0.1	1.671	39
468.2	19.0	-10.4	0.8590	0.4574	0.4016	0.7	1.457	40
452.0	20.0	-12.0	0.8525	0.4532	0.3993	1.9	1.526	45
440.7	21.0	-13.5	0.8451	0.4541	0.3910	2.3		M
427.4	22.0	-15.2	0.8381	0.4550	0.3831	1.7	1.213	44
411.3	23.0	-16.9	0.8282	0.4467	0.3815	1.1	1.093	43
393.1	24.0	-18.5	0.8193	0.4369	0.3824	1.1	1.005	44
380.3	25.0	-20.5	0.8118	0.4350	0.3768	1.6	0.860	43
366.7	26.0	-22.6	0.8037	0.4337	0.3700	0.6	0.739	43
353.3	27.0	-24.9	0.7964	0.4271	0.3693	-1.3	0.608	42
339.9	28.0	-27.4	0.7913	0.4125	0.3789	-1.9	0.500	41
326.9	29.0	-29.8	0.7869	0.4003	0.3865	-0.4	0.407	41
314.1	30.0	-32.1	0.7806	0.3983	0.3823	1.9	0.338	40
301.3	31.0	-33.9	0.7717	0.3995	0.3721	3.6	0.278	39
294.0	32.0	-35.8	0.7620	0.3960	0.3660	2.1	0.253	39
284.4	33.0	-37.7	0.7529	0.3883	0.3646	0.2	0.205	39
272.1	34.0	-39.9	0.7494	0.3822	0.3672	-0.3	0.174	39
257.2	35.0	-41.8	0.7460	0.3762	0.3698	0.5	0.150	39
247.0	36.0	-43.9	0.7401	0.3731	0.3669	2.2	0.125	39
235.8	37.0	-46.3	0.7327	0.3737	0.3590	2.9	0.101	39
225.3	38.0	-48.3	0.7271	0.3746	0.3525	2.7	0.084	39
215.8	39.0	-50.0	0.7232	0.3724	0.3508	1.9	0.074	39
207.0	40.0	-51.6	0.7175	0.3693	0.3482	1.9		A
197.9	41.0	-53.4	0.7111	0.3654	0.3456	3.1		A
189.3	42.0	-55.2	0.7042	0.3639	0.3403	3.9		A
180.7	43.0	-57.2	0.6991	0.3674	0.3316	3.8		A
172.1	44.0	-59.5	0.6992	0.3728	0.3263	2.2		A
162.9	45.0	-61.7	0.6981	0.3736	0.3245	0.3		A
154.1	46.0	-63.6	0.6970	0.3692	0.3277	-0.4		A
146.2	47.0	-65.1	0.6949	0.3658	0.3290	0.3		A
138.5	48.0	-66.8	0.6938	0.3673	0.3265	1.9		A
131.7	49.0	-68.5	0.6924	0.3693	0.3231	2.7		A
125.6	50.0	-69.6	0.6900	0.3709	0.3191	2.4		A
120.3	51.0	-70.5	0.6897	0.3718	0.3179	1.4		A
113.5	52.0	-70.3	0.6882	0.3713	0.3169	0.4		A
106.5	53.0	-69.4	0.6856	0.3685	0.3171	-0.0		A
99.8	54.0	-68.1	0.6821	0.3648	0.3172	-0.4		A
94.2	55.0	-67.5	0.6819	0.3640	0.3150	-0.3		A
88.7	56.0	-67.1	0.6849	0.3663	0.3187	-0.3		A
83.6	57.0	-66.6	0.6896	0.3717	0.3179	0.1		A
78.7	58.0	-65.3	0.6930	0.3744	0.3187	-0.0		A
74.1	59.0	-63.6	0.6923	0.3747	0.3176	-0.4		A
69.7	60.0	-61.9	0.6931	0.3741	0.3190	-1.1		A
65.3	61.0	-60.4	0.6951	0.3756	0.3195	-2.8		A
61.4	62.0	-59.6	0.7000	0.3780	0.3220	-3.8		A
56.9	63.3	-59.3	0.7097	0.3829	0.3268	-6.2		A

1FILTERED RADIOMETERSONDE RUN FOR PH5 6 SEP 1973 OPUS 21

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
953.8	0.0	35.0	0.7352	0.6955	0.0397	0.0	11.898	38
929.6	1.0	34.9	0.7611	0.6798	0.0813	-10.1	14.910	39
904.6	2.0	35.4	0.7628	0.6737	0.0891	-3.0	15.568	39
879.5	3.0	32.4	0.7727	0.6741	0.0986	-2.7	14.012	39
852.6	4.0	29.1	0.7809	0.6673	0.1136	-2.6	11.355	40
825.8	5.0	26.3	0.7858	0.6577	0.1281	-1.6	11.593	43
799.8	6.0	24.3	0.7819	0.6492	0.1327	0.2	10.518	45
774.4	7.0	21.7	0.7708	0.6468	0.1240	1.4	9.383	44
749.7	8.0	19.6	0.7529	0.6410	0.1119	0.8	8.012	42
724.8	9.0	17.2	0.7378	0.6300	0.1078	-1.2	7.477	43
699.0	10.0	14.7	0.7302	0.6075	0.1227	-2.5	6.602	44
674.6	11.0	12.1	0.7220	0.5781	0.1440	-1.2	5.861	45
651.0	12.0	9.6	0.7102	0.5648	0.1455	1.7	5.248	45
629.2	13.0	7.2	0.6957	0.5737	0.1219	4.0	6.716	66
608.3	14.0	4.6	0.6866	0.5862	0.1004	3.4	6.540	74
587.7	15.0	1.9	0.6790	0.5865	0.0925	0.3	5.967	78
566.8	16.0	-0.8	0.6725	0.5736	0.0989	-3.7	5.208	82
546.4	17.0	-2.8	0.6662	0.5488	0.1174	-7.3	5.128	90
525.9	18.0	-3.9	0.6656	0.5117	0.1538	-9.3	2.274	41
505.4	19.0	-4.5	0.6684	0.4749	0.1935	-8.3	1.447	27
486.8	20.0	-5.0	0.6703	0.4518	0.2185	-5.4	1.430	26
470.0	21.0	-5.2	0.6673	0.4453	0.2220	-2.5	1.441	26
454.0	22.0	-5.6	0.6628	0.4403	0.2225	-1.2	1.464	26
439.2	23.0	-6.9	0.6626	0.4360	0.2266	-1.8	1.415	26
424.7	24.0	-9.2	0.6658	0.4340	0.2318	-2.9	1.148	26
410.9	25.0	-11.7	0.6687	0.4290	0.2397	-2.8	0.929	24
391.4	26.0	-14.0	0.6718	0.4194	0.2523	-2.8	0.840	25
375.6	27.0	-16.4	0.6740	0.4173	0.2567	-2.3	0.709	25
363.1	28.0	-18.6	0.6725	0.4123	0.2603	-1.8	0.622	25
354.1	29.0	-20.8	0.6677	0.4045	0.2632	-2.3	0.560	26
339.8	30.0	-22.9	0.6646	0.3956	0.2689	-2.6	0.469	26
327.3	31.0	-25.1	0.6663	0.3922	0.2741	-4.1	0.413	27
314.7	32.0	-27.2	0.6727	0.3887	0.2840	-4.9	0.353	26
302.3	33.0	-29.4	0.6806	0.3908	0.2998	-5.2	0.293	26
289.7	34.0	-31.7	0.6839	0.3754	0.3085	-4.6	0.255	27
277.0	35.0	-33.8	0.6872	0.3700	0.3172	-4.0	0.215	27
264.1	36.0	-35.9	0.6897	0.3648	0.3249	-3.5	0.184	27

1FILTERED RADIOMETERSONDE RUN FOR PHS 6 SEP 1973 OPUS 22

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
954.2	0.0	50.2	0.8915	0.7999	0.0916	0.0	10.651	41
925.2	1.0	26.5	0.9534	0.7931	0.1603	-13.9	9.944	42
896.8	2.0	24.4	0.9506	0.7931	0.1575	0.6	9.332	43
869.1	3.0	22.3	0.9454	0.7910	0.1544	0.3	8.600	44
842.1	4.0	20.2	0.9362	0.7836	0.1526	-0.4	7.628	43
815.9	5.0	18.3	0.9286	0.7727	0.1559	-0.9	6.775	42
790.1	6.0	16.1	0.9253	0.7604	0.1650	-0.7	6.102	41
763.7	7.0	13.4	0.9193	0.7501	0.1692	0.3	5.550	44
737.3	8.0	10.7	0.9027	0.7403	0.1624	1.2	4.819	44
710.7	9.0	8.1	0.8848	0.7342	0.1506	1.4	4.877	50
685.4	10.0	5.4	0.8738	0.7266	0.1472	0.8	4.795	58
662.0	11.0	3.2	0.8624	0.7151	0.1473	0.2	4.645	65
639.6	12.0	1.0	0.8522	0.7051	0.1470	-0.3	5.389	79
617.5	13.0	-1.2	0.8398	0.6928	0.1470	-0.9	4.724	86
595.5	14.0	-3.6	0.8299	0.6767	0.1532	-1.8	1.389	28
574.2	15.0	-4.6	0.8218	0.6601	0.1617	-3.0	1.300	28
554.5	16.0	-5.2	0.8200	0.6471	0.1729	-3.7	1.242	26
536.2	17.0	-5.4	0.8235	0.6352	0.1884	-3.5	1.236	25
518.6	18.0	-5.6	0.8292	0.6284	0.2008	-2.3	1.230	25
500.4	19.0	-6.5	0.8290	0.6265	0.2025	-1.1	1.219	25
483.7	20.0	-8.2	0.8277	0.6270	0.2008	-0.9	1.090	25
467.7	21.0	-10.7	0.8279	0.6232	0.2047	-1.3	0.943	26
451.7	22.0	-13.2	0.8262	0.6143	0.2119	-1.5	0.789	26
435.5	23.0	-15.5	0.8214	0.6067	0.2147	-1.1	0.684	26
419.5	24.0	-17.7	0.8199	0.6036	0.2163	-1.1	0.713	31
404.5	25.0	-20.3	0.8176	0.6005	0.2170	-1.9	0.605	32
389.7	26.0	-22.7	0.8113	0.5865	0.2248	-2.8	0.518	33
375.0	27.0	-24.7	0.8007	0.5658	0.2348	-2.7	0.462	33
360.1	28.0	-26.6	0.7924	0.5490	0.2434	-0.8	0.391	32
346.1	29.0	-28.9	0.7881	0.5473	0.2407	1.4	0.314	30
332.9	30.0	-31.2	0.7899	0.5585	0.2314	2.7	0.261	30
320.0	31.0	-33.3	0.7898	0.5652	0.2246	2.4	0.223	31
307.0	32.0	-35.2	0.7885	0.5676	0.2210	0.7	0.194	31
293.8	33.0	-37.2	0.7832	0.5634	0.2197	-1.7	0.172	31
281.4	34.0	-39.4	0.7731	0.5471	0.2259	-4.6	0.139	31
269.7	35.0	-41.3	0.7613	0.5207	0.2406	-6.4	0.121	31
258.1	36.0	-43.2	0.7553	0.4973	0.2580	-5.5	0.107	31
246.0	37.0	-45.6	0.7600	0.4915	0.2685	-3.0	0.082	31
233.9	38.0	-48.4	0.7671	0.4996	0.2675	-0.1	0.066	31
222.0	39.0	-50.9	0.7758	0.509[illegible]	0.2664	1.7		A
211.3	40.0	-53.3	0.7816	0.5213	0.2604	2.6		A
201.7	41.0	-55.5	0.7839	0.5277	0.2562	3.4		A
192.0	42.0	-57.5	0.7817	0.5318	0.2499	3.5		A
182.2	43.0	-59.3	0.7784	0.5354	0.2430	2.8		A
173.0	44.0	-60.8	0.7764	0.5378	0.2386	1.4		A
163.7	45.0	-62.4	0.7761	0.5371	0.2390	-0.5		A
154.4	46.0	-64.2	0.7750	0.5342	0.2408	-3.1		A
145.8	47.0	-66.1	0.7709	0.5254	0.2455	-6.4		A
138.0	48.0	-67.5	0.7677	0.5095	0.2582	-8.3		A
129.9	49.0	-68.8	0.7667	0.4909	0.2757	-6.8		A
122.3	50.0	-70.1	0.7657	0.4839	0.2818	-2.6		A
114.7	51.0	-71.4	0.7657	0.4870	0.2788	1.7		A
107.3	52.0	-71.4	0.7654	0.4917	0.2737	2.3		A
99.8	53.0	-70.0	0.7640	0.4950	0.2690	0.8		A
93.2	54.0	-68.1	0.7643	0.4922	0.2722	-0.8		A
87.4	55.0	-66.5	0.7655	0.4907	0.2748	-1.1		A
82.6	56.0	-65.0	0.7659	0.4907	0.2752	0.5		A
78.0	57.0	-63.6	0.7635	0.4911	0.2724	1.2		A
73.6	58.0	-62.1	0.7620	0.4908	0.2713	1.0		A
69.4	59.0	-60.6	0.7612	0.4892	0.2720	0.2		A
65.6	60.0	-59.2	0.7598	0.4880	0.2718	-0.6		A

61.8	61.0	-57.8	0.7591	0.4876	0.2715	-1.0	A
58.2	62.0	-56.9	0.7610	0.4876	0.2733	-1.8	A
55.1	63.0	-55.8	0.7616	0.4872	0.2744	-2.1	A
52.2	64.0	-54.2	0.7598	0.4843	0.2755	-1.5	A
49.2	65.0	-52.9	0.7583	0.4830	0.2759	-1.3	A
46.5	66.0	-52.4	0.7598	0.4834	0.2764	-0.7	A
44.3	67.0	-51.7	0.7606	0.4836	0.2771	0.0	A
42.5	68.0	-50.7	0.7601	0.4837	0.2763	0.1	A
40.6	69.0	-50.3	0.7628	0.4870	0.2758	-1.5	A
38.8	70.0	-49.5	0.7650	0.4881	0.2768	-7.5	A
36.9	71.0	-48.3	0.7645	0.4854	0.2792	-14.9	A
35.3	72.0	-47.1	0.7645	0.4781	0.2863	-20.7	A
34.0	73.0	-46.1	0.7651	0.4728	0.2924	-22.7	A
33.0	74.0	-44.9	0.7683	0.4723	0.2960	-22.6	A
31.9	75.0	-43.9	0.7839	0.4856	0.2983	-17.4	A
30.9	76.0	-43.2	0.8123	0.5083	0.3040	-3.4	A
29.9	77.0	-42.7	0.8412	0.5375	0.3037	7.8	A
28.8	78.0	-42.2	0.8525	0.5562	0.2963	16.6	A
27.8	79.0	-41.7	0.8588	0.5635	0.2953	10.8	A
26.7	80.0	-41.5	0.8624	0.5691	0.2933	-9.1	A
25.7	81.0	-41.3	0.8704	0.5749	0.2955	-28.0	A
24.6	82.0	-41.2	0.8804	0.5761	0.3043	-54.4	A
23.7	83.0	-41.0	0.8895	0.5751	0.3144	-67.1	A
23.0	84.0	-40.8	0.8987	0.5713	0.3274	-99.7	A

1FILTERED RADIOMETERSONDE RUN FOR PH5 6 SEP 1973 OPUS 23

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
951.0	0.0	62.0	1.0290	0.7249	0.3041	0.0	9.197	19
927.8	1.0	35.4	1.0571	0.7692	0.2879	4.1	12.248	34
905.6	2.0	32.3	1.0848	0.7989	0.2859	2.2	11.780	34
894.5	3.0	31.3	1.0910	0.8167	0.2743	3.6	11.663	35
864.2	4.0	29.8	1.0869	0.8255	0.2593	3.8	10.594	35
842.9	5.0	27.8	1.0688	0.8294	0.2394	2.7	9.947	35
821.3	6.0	25.7	1.0630	0.8276	0.2354	1.3	8.563	34
797.1	7.0	23.2	1.0521	0.8175	0.2346	0.9	7.329	32
771.9	8.0	20.5	1.0343	0.8014	0.2329	0.8	6.430	32
746.7	9.0	17.8	1.0122	0.7892	0.2230	0.9	5.832	34
723.0	10.0	15.2	0.9980	0.7737	0.2243	1.0	5.728	38
698.9	11.0	12.7	0.9846	0.7643	0.2203	1.1	6.046	46
675.3	12.0	10.1	0.9708	0.7580	0.2129	0.8	5.776	50
651.6	13.0	7.5	0.9572	0.7503	0.2070	-0.4	5.536	55
628.3	14.0	4.9	0.9472	0.7320	0.2153	-1.7	5.214	61
606.0	15.0	2.3	0.9355	0.7078	0.2278	-1.9	4.455	59
584.7	16.0	0.2	0.9189	0.6845	0.2345	-1.4	2.877	43
564.5	17.0	-1.8	0.9026	0.6692	0.2334	-1.4	1.609	27
545.7	18.0	-3.3	0.8911	0.6540	0.2371	-2.4	1.280	23
528.0	19.0	-3.6	0.8844	0.6351	0.2492	-3.5	1.195	22
510.0	20.0	-3.3	0.8829	0.6190	0.2638	-3.6	1.164	20
491.9	21.0	-3.4	0.8841	0.6106	0.2735	-3.0	1.185	19
474.2	22.0	-4.7	0.8886	0.6083	0.2803	-2.3	1.081	19
456.8	23.0	-6.8	0.8885	0.6020	0.2865	-1.9	0.952	19
440.2	24.0	-9.1	0.8823	0.5910	0.2913	-1.7	0.863	20
423.9	25.0	-11.7	0.8738	0.5784	0.2954	-1.7	0.732	20
407.9	26.0	-14.5	0.8701	0.5700	0.3001	-1.9	0.614	20
392.1	27.0	-16.9	0.8667	0.5611	0.3056	-2.1	0.518	20
377.2	28.0	-19.8	0.8647	0.5535	0.3112	-2.3	0.451	20
362.7	29.0	-22.3	0.8589	0.5422	0.3167	-2.2	0.3[illegible]2	20
348.0	30.0	-24.3	0.8542	0.5309	0.3234	-1.4	0.333	21
334.7	31.0	-25.7	0.8473	0.5207	0.3267	-0.6	0.297	21
322.1	32.0	-27.9	0.8427	0.5202	0.3225	-0.1	0.269	22
309.3	33.0	-30.0	0.8383	0.5146	0.3237	-0.2	0.236	23
296.1	34.0	-32.0	0.8328	0.5068	0.3260	0.1	0.203	23
283.8	35.0	-34.1	0.8258	0.4992	0.3265	0.8	0.175	23
272.2	36.0	-36.2	0.8160	0.4955	0.3204	1.2	0.146	23
261.1	37.0	-38.4	0.8099	0.4914	0.3185	0.5	0.122	23
249.5	38.0	-40.7	0.8053	0.4866	0.3187	-0.5	0.101	22
237.6	39.0	-43.0	0.8007	0.4794	0.3213	-1.4	0.083	23
225.6	40.0	-45.4	0.7953	0.4709	0.3244	-1.9	0.067	22
214.2	41.0	-47.9	0.7900	0.4603	0.3297	-1.9	0.054	22
203.0	42.0	-50.4	0.7858	0.4529	0.3329	-1.6		A
193.1	43.0	-52.9	0.7854	0.4500	0.3353	-1.1		A
183.9	44.0	-55.3	0.7831	0.4476	0.3355	-0.2		A
175.0	45.0	-57.3	0.7803	0.4432	0.3372	0.7		A
165.9	46.0	-59.3	0.7748	0.4411	0.3337	0.8		A
157.2	47.0	-61.3	0.7722	0.4409	0.3312	-0.4		A
148.9	49.0	-62.9	0.[illegible]597	0.4372	0.3325	-2.4		A
141.0	49.0	-64.4	0.7685	0.4281	0.3404	-3.0		A
132.9	50.0	-65.5	0.7655	0.4197	0.3458	-1.6		A
125.2	51.0	-66.7	0.7613	0.4165	0.3447	-0.2		A
117.8	52.0	-67.6	0.7559	0.4147	0.3412	-0.0		A
111.2	53.0	-68.9	0.7541	0.4102	0.3439	-1.1		A
104.7	54.0	-70.1	0.7517	0.4052	0.3464	-2.0		A
98.5	55.0	-70.5	0.7471	0.3985	0.3485	-2.1		A
92.5	56.0	-70.2	0.7418	0.3920	0.3499	-2.6		A
87.0	57.0	-69.9	0.7409	0.3878	0.3530	-3.3		A
81.7	58.0	-67.9	0.7389	0.3820	0.3569	-4.1		A
76.8	59.0	-64.6	0.7339	0.3740	0.3599	-4.6		A
72.2	60.0	-62.0	0.7302	0.3663	0.3639	-4.8		A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

67.7	61.0	-60.7	0.7310	0.3627	0.3683	-4.7	A
63.4	62.0	-59.6	0.7327	0.3612	0.3715	-4.3	A
59.6	63.0	-58.8	0.735[illegible]	0.3619	0.3734	-4.1	A
55.9	64.0	-58.7	0.7408	0.3647	0.3761	-5.4	A
52.4	65.0	-58.2	0.7446	0.3652	0.3794	-6.3	A
49.3	66.0	-57.3	0.7470	0.3624	0.3846	-5.2	A
46.4	67.0	-56.3	0.7468	0.3597	0.3870	-0.9	A
43.4	68.0	-55.7	0.7481	0.3623	0.3859	4.9	A
40.7	69.0	-55.4	0.7491	0.3681	0.3810	8.4	A
38.2	70.0	-54.7	0.7486	0.3727	0.3760	[illegible].0	A
35.8	71.0	-53.6	0.7471	0.3740	0.3731	6.5	A
33.4	72.0	-52.7	0.7453	0.3745	0.3708	3.1	A
31.1	73.0	-51.5	0.7433	0.3731	0.3702	0.5	A
29.0	74.0	-49.7	0.7397	0.3685	0.3712	-1.8	A
27.2	75.0	-47.8	0.7359	0.3639	0.3720	-3.1	A
25.4	76.0	-46.6	0.7344	0.3615	0.3728	-4.1	A
23.6	77.0	-46.0	0.7364	0.3621	0.3743	-5.4	A
21.8	78.0	-45.5	0.7398	0.3635	0.3763	-5.4	A
20.0	79.0	-45.1	0.7435	0.3649	0.3786	-6.5	A
18.5	80.0	-44.7	0.7449	0.3661	0.3788	-11.3	A
17.2	81.0	-44.2	0.7469	0.3650	0.3819	-20.7	A
16.0	82.0	-43.5	0.7507	0.3622	0.3884	-30.0	A
14.7	83.0	-42.7	0.7572	0.3604	0.3967	-32.4	A
13.5	84.0	-42.2	0.7645	0.3614	0.4030	-35.2	A
12.2	85.0	-41.8	0.7714	0.3618	0.4096	-32.9	A
10.9	86.0	-40.9	0.7777	0.3582	0.4194	-28.8	A
9.8	87.0	-39.6	0.7791	0.3556	0.4235	-21.1	A
8.8	88.0	-37.8	0.7773	0.3521	0.4252	-9.6	A

1FILTERED RADIOMETERSONDE RUN FOR PHX 6 SEP 1973 OPUS 24

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
949.6	0.0	27.6	0.7066	0.7531	-0.0465	0.0	6.422	26
922.2	1.0	26.7	0.6979	0.7353	-0.0374	-1.9	6.338	26
894.7	2.0	25.4	0.6986	0.6884	0.0103	-6.2	6.007	26
866.7	3.0	23.5	0.6939	0.6529	0.0410	-6.2	5.648	27
839.5	4.0	21.5	0.6844	0.6246	0.0598	-4.8	5.410	28
813.2	5.0	19.5	0.6765	0.5947	0.0818	-3.7	5.099	29
787.1	6.0	17.3	0.6659	0.5674	0.0985	-2.6	4.997	31
762.1	7.0	14.9	0.6519	0.5484	0.1035	-1.7	5.199	37
736.4	8.0	12.1	0.6377	0.5325	0.1052	-2.0	4.376	36
710.9	9.0	9.3	0.6263	0.5108	0.1155	-3.1	3.432	33
685.3	10.0	6.7	0.6208	0.4841	0.1367	-3.5	3.207	36
660.3	11.0	4.1	0.6147	0.4605	0.1541	-2.8	2.881	36
634.7	12.0	1.3	0.6040	0.4423	0.1618	-1.2	2.436	37
610.5	13.0	-1.7	0.5924	0.4290	0.1634	0.8	2.198	39
587.7	14.0	-4.8	0.5844	0.4263	0.1580	2.7	1.239	27
565.7	15.0	-7.7	0.5753	0.4362	0.1391	3.3	0.873	23
544.6	16.0	-9.9	0.5691	0.4476	0.1215	1.6	0.711	21
524.5	17.0	-11.6	0.5660	0.4450	0.1210	-2.1	0.654	21
505.2	18.0	-13.3	0.5657	0.4261	0.1396	-5.2	0.595	22
486.2	19.0	-15.2	0.5645	0.3989	0.1656	-5.8	0.530	22
467.7	20.0	-17.4	0.5614	0.3780	0.1834	-4.7	0.443	21
448.9	21.0	-19.7	0.5539	0.3614	0.1925	-3.8	0.382	21
431.9	22.0	-21.9	0.5468	0.3461	0.2007	-3.7	0.325	21
416.1	23.0	-24.2	0.5426	0.3298	0.2128	-4.3	0.281	21
400.2	24.0	-26.5	0.5380	0.3123	0.2256	-4.3	0.240	22
383.1	25.0	-28.7	0.5342	0.2948	0.2393	-3.5	0.212	22
367.1	26.0	-30.9	0.5282	0.2817	0.2466	-2.5	0.175	22
351.6	27.0	-32.9	0.5213	0.2709	0.2504	-2.0	0.151	22
337.8	28.0	-35.0	0.5173	0.2633	0.2540	-2.1	0.131	22
325.5	29.0	-37.2	0.5169	0.2566	0.2603	-2.5	0.113	23
314.1	30.0	-38.9	0.5146	0.2489	0.2656	-2.7	0.095	22
302.1	31.0	-40.4	0.5089	0.2394	0.2705	-2.7	0.086	23
289.7	32.0	-41.9	0.5018	0.2253	0.2765	-2.9	0.076	23
277.4	33.0	-43.4	0.4964	0.2134	0.2830	-3.0	0.069	23
265.8	34.0	-44.9	0.4915	0.2019	0.2896	-3.1	0.060	22
254.9	35.0	-46.4	0.4862	0.1924	0.2939	-3.8	0.054	23
244.3	36.0	-48.0	0.4821	0.1813	0.3008	-4.6	0.050	23
233.6	37.0	-49.6	0.4800	0.1679	0.3120	-5.4	0.043	24
223.4	38.0	-51.3	0.4787	0.1567	0.3220	-6.0		A
213.7	39.0	-52.9	0.4766	0.1459	0.3307	-6.3		A
205.1	40.0	-54.6	0.4755	0.1336	0.3419	-6.9		A
197.3	41.0	-56.4	0.4728	0.1211	0.3517	-6.6		A
189.1	42.0	-58.2	0.4698	0.1094	0.3604	-6.4		A
181.1	43.0	-59.9	0.4661	0.0984	0.3677	-5.5		A
173.2	44.0	-61.4	0.4630	0.0860	0.3770	-3.8		A
166.5	45.0	-63.0	0.4580	0.0784	0.3796	-1.2		A
158.4	46.0	-64.8	0.4533	0.0742	0.3791	1.6		A
150.4	47.0	-66.4	0.4497	0.0757	0.3740	3.2		A
143.1	48.0	-67.7	0.4464	0.0774	0.3690	3.6		A
136.6	49.0	-68.7	0.4435	0.0787	0.3648	2.5		A
130.5	50.0	-69.7	0.4420	0.0798	0.3622	-0.5		A
124.7	51.0	-70.5	0.4411	0.0772	0.3639	-3.1		A
119.0	52.0	-71.5	0.4429	0.0709	0.3720	-3.7		A
113.3	53.0	-72.5	0.4431	0.0678	0.3753	-0.1		A
107.4	54.0	-73.4	0.4434	0.0694	0.3740	4.7		A
101.4	55.0	-73.8	0.4398	0.0762	0.3636	7.5		A
95.9	56.0	-74.2	0.4381	0.0835	0.3546	8.6		A
92.2	57.0	-74.6	0.4390	0.0885	0.3505	7.8		A
88.7	58.0	-74.9	0.4423	0.0960	0.3463	6.8		A
85.0	59.0	-75.0	0.4477	0.1059	0.3418	4.6		A
81.3	60.0	-74.7	0.4505	0.1128	0.3378	3.4		A

77.5	61.0	-74.4	0.4543	0.1137	0.3407	4.0	A
73.3	62.0	-74.1	0.4554	0.1199	0.3395	5.1	A
69.0	63.0	-73.9	0.4562	0.1265	0.3293	5.0	A
64.7	64.0	-73.5	0.4549	0.1291	0.3259	3.2	A
60.1	65.0	-73.4	0.4589	0.1319	0.3270	2.0	A
56.3	66.0	-72.9	0.4613	0.1362	0.3251	3.1	A
53.8	67.0	-72.3	0.4630	0.1402	0.3229	5.9	A
51.9	68.0	-71.8	0.4621	0.1427	0.3194	7.9	A
50.3	69.0	-71.6	0.4636	0.1459	0.3177	10.5	A
48.9	70.0	-71.2	0.4653	0.1498	0.3155	11.3	A
46.7	71.0	-70.7	0.4660	0.1563	0.3097	11.0	A
43.2	72.0	-70.4	0.4668	0.1636	0.3032	11.3	A
40.3	73.0	-69.9	0.4675	0.1680	0.2995	12.7	A
38.7	74.0	-69.3	0.4679	0.1733	0.2946	12.9	A
37.0	75.0	-68.7	0.4674	0.1792	0.2881	8.8	A
35.3	76.0	-68.4	0.4697	0.1815	0.2881	2.5	A
33.7	77.0	-68.1	0.4736	0.1829	0.2907	2.3	A
32.0	78.0	-67.7	0.4763	0.1865	0.2898	9.1	A
30.2	79.0	-67.3	0.4751	0.1911	0.2839	15.6	A
28.9	80.0	-67.0	0.4728	0.1937	0.2791	16.0	A
28.1	81.0	-66.6	0.4713	0.1951	0.2761	6.9	A
26.7	82.0	-66.4	0.4721	0.1947	0.2773	5.8	A
25.3	83.0	-66.0	0.4727	0.1949	0.2777	12.5	A
23.9	84.0	-65.8	0.4711	0.1992	0.2719	15.7	A
23.0	85.0	-65.4	0.4673	0.2022	0.2651	11.3	A
22.0	86.0	-65.5	0.4692	0.2016	0.2676	3.5	A
21.0	87.0	-65.5	0.4729	0.2026	0.2703	12.5	A
20.0	88.0	-65.4	0.4764	0.2101	0.2663	37.6	A
19.0	89.0	-65.0	0.4775	0.2223	0.2551	51.9	A
18.0	90.0	-64.8	0.4797	0.2366	0.2432	39.8	A
17.0	91.0	-64.7	0.4827	0.2449	0.2377	9.3	A
16.0	92.0	-64.6	0.4872	0.2461	0.2412	-16.0	A
15.0	93.0	-64.4	0.4906	0.2424	0.2482	-22.5	A
14.0	94.0	-64.2	0.4930	0.2415	0.2515	-16.5	A
13.0	95.0	-64.1	0.4968	0.2451	0.2517	-4.5	A
12.2	96.0	-64.0	0.5014	0.2485	0.2529	-3.2	A
11.4	97.0	-64.0	0.5013	0.2503	0.2510	-13.0	A
10.6	98.0	-63.9	0.5030	0.2488	0.2542	-32.5	A
9.7	99.0	-63.8	0.5050	0.2449	0.2601	-50.3	A
8.9	100.0	-63.8	0.5098	0.2386	0.2713	-47.1	A
8.1	101.0	-64.1	0.5123	0.2344	0.2779	-16.4	A
7.3	102.0	-64.3	0.5146	0.2365	0.2781	25.1	A
6.5	103.0	-64.4	0.5162	0.2481	0.2681	54.6	A
5.6	104.0	-64.3	0.5172	0.2583	0.2589	67.2	A
4.8	105.0	-64.1	0.5179	0.2684	0.2494	51.2	A
3.9	106.0	-63.8	0.5186	0.2780	0.2406	28.5	A
3.3	107.0	-63.6	0.5226	0.2805	0.2420	-0.3	A
3.0	108.0	-63.4	0.5257	0.2796	0.2461	-17.0	A
3.0	109.0	-63.3	0.5269	0.2800	0.2468	90.7	A
2.9	110.0	-63.1	0.5262	0.2845	0.2417	252.7	A
2.8	111.0	-63.1	0.5250	0.2885	0.2365	302.4	A
2.7	112.0	-63.0	0.5229	0.2931	0.2298	396.7	A

1FILTERED RADIOMETERSONDE RUN FOR PH5 7 SEP 1973 OPUS 25

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
952.7	0.0	39.0	0.7742	0.6021	0.1721	0.0	12.846	35
925.0	1.0	30.4	0.7948	0.6367	0.1581	3.0	9.485	35
897.5	2.0	27.7	0.7983	0.6326	0.1657	-1.2	9.645	36
869.4	3.0	27.1	0.8006	0.6247	0.1760	-1.5	9.751	37
843.0	4.0	25.5	0.8017	0.6179	0.1839	-1.4	8.010	33
816.0	5.0	23.4	0.7992	0.6121	0.1872	-1.1	7.884	35
790.3	6.0	21.0	0.7944	0.6033	0.1911	-1.0	7.019	36
765.7	7.0	18.6	0.7906	0.5943	0.1964	-1.1	6.495	37
742.3	8.0	16.4	0.7834	0.5832	0.2002	-1.2	6.160	39
718.7	9.0	13.9	0.7749	0.5703	0.2046	-1.5	5.600	40
695.1	10.0	11.1	0.7682	0.5569	0.2113	-2.2	5.552	46
672.3	11.0	8.4	0.7626	0.5422	0.2205	-3.0	5.059	49
651.0	12.0	6.0	0.7564	0.5205	0.2359	-3.3	4.847	53
629.7	13.0	4.9	0.7471	0.4986	0.2485	-3.0	2.986	35
606.8	14.0	4.2	0.7393	0.4815	0.2578	-2.8	2.333	26
584.8	15.0	3.3	0.7352	0.4690	0.2662	-2.9	2.108	26
564.5	16.0	1.3	0.7349	0.4558	0.2791	-2.7	1.943	26
545.0	17.0	-1.0	0.7338	0.4441	0.2898	-2.1	1.673	26
525.2	18.0	-3.5	0.7323	0.4393	0.2930	-1.6	1.479	26
505.8	19.0	-5.8	0.7280	0.4335	0.2946	-1.6	1.266	26
487.1	20.0	-8.0	0.7255	0.4226	0.3028	-1.8	1.135	26
469.1	21.0	-10.2	0.7233	0.4129	0.3104	-1.8	1.039	27
451.8	22.0	-12.7	0.7192	0.4057	0.3135	-1.6	0.869	27
435.3	23.0	-14.6	0.7129	0.3959	0.3169	-1.7	0.753	27
418.7	24.0	-15.9	0.7068	0.3837	0.3231	-2.0	0.721	27
401.9	25.0	-17.7	0.7053	0.3751	0.3302	-2.1	0.646	26
385.4	26.0	-20.1	0.7053	0.3701	0.3352	-1.7	0.496	25
369.5	27.0	-22.4	0.7050	0.3642	0.3408	-1.2	0.446	25
354.4	28.0	-24.4	0.7035	0.3625	0.3410	-1.0	0.387	25
339.7	29.0	-26.8	0.7036	0.3601	0.3435	-0.6	0.331	26
326.3	30.0	-29.1	0.7017	0.3549	0.3469	-0.2	0.286	27
312.8	31.0	-30.9	0.6978	0.3529	0.3449	0.3	0.252	27
298.7	32.0	-32.6	0.6934	0.3507	0.3427	-0.1	0.233	27
284.8	33.0	-34.6	0.6886	0.3460	0.3426	-1.2	0.199	28
271.2	34.0	-37.1	0.6871	0.3374	0.3497	-2.2	0.166	28
258.6	35.0	-39.7	0.6863	0.3312	0.3551	-2.5	0.131	28
245.6	36.0	-42.4	0.6870	0.3260	0.3610	-1.8	0.107	28
233.2	37.0	-44.9	0.6864	0.3219	0.3645	-0.7	0.085	28
221.0	38.0	-47.4	0.6849	0.3207	0.3642	0.2	0.069	28
210.3	39.0	-49.9	0.6828	0.3223	0.3606	0.7	0.055	28
199.4	40.0	-52.7	0.6814	0.3208	0.3607	1.0		A
188.3	41.0	-55.3	0.6791	0.3191	0.3600	1.2		A
178.3	42.0	-57.7	0.6750	0.3193	0.3557	1.5		A
169.4	43.0	-59.7	0.6715	0.3189	0.3526	1.4		A
160.3	44.0	-61.5	0.6690	0.3174	0.3516	0.5		A
151.1	45.0	-63.2	0.6660	0.3147	0.3512	-1.0		A
142.8	46.0	-65.2	0.6639	0.3110	0.3529	-2.8		A
135.3	47.0	-66.8	0.6643	0.3047	0.3597	-3.4		A
127.7	48.0	-67.8	0.6645	0.2983	0.3663	-2.5		A
120.3	49.0	-69.3	0.6674	0.3007	0.3667	-1.3		A
112.5	50.0	-70.6	0.6698	0.3043	0.3655	-0.4		A
105.7	51.0	-71.6	0.6745	0.3062	0.3682	-0.2		A
99.5	52.0	-72.3	0.6769	0.3088	0.3682	0.1		A
93.7	53.0	-72.7	0.6786	0.3121	0.3665	0.6		A
87.7	54.0	-71.7	0.6786	0.3129	0.3657	-0.6		A
82.4	55.0	-69.8	0.6801	0.3136	0.3665	-1.1		A
77.6	56.0	-68.1	0.6872	0.3161	0.3711	0.3		A
73.0	57.0	-66.4	0.6890	0.3204	0.3686	4.2		A
68.7	58.0	-64.9	0.6869	0.3233	0.3636	5.2		A
64.5	59.0	-63.2	0.6800	0.3258	0.3543	3.3		A
60.5	60.0	-61.5	0.6846	0.3254	0.3593	0.8		A

56.9	61.0	-60.5	0.6876	0.3283	0.3593	-0.6	A
53.6	62.0	-60.0	0.6912	0.3327	0.3585	2.4	A
50.3	63.0	-60.0	0.6954	0.3389	0.3565	3.2	A
47.3	64.0	-60.2	0.6976	0.3438	0.3538	1.1	A
44.5	65.0	-59.7	0.6969	0.3438	0.3532	-5.2	A
41.8	66.0	-58.5	0.6968	0.3394	0.3574	-12.9	A
39.0	67.0	-57.4	0.7021	0.3352	0.3670	-17.0	A
36.6	68.0	-56.1	0.7133	0.3369	0.3764	-12.1	A
34.7	69.0	-54.5	0.7230	0.3434	0.3796	-2.5	A
33.1	70.0	-52.9	0.7272	0.3538	0.3735	2.8	A
31.4	71.0	-51.5	0.7323	0.3599	0.3725	-0.2	A
29.7	72.0	-50.1	0.7386	0.3626	0.3760	-6.7	A
28.0	73.0	-49.2	0.7421	0.3634	0.3787	-6.6	A
26.2	74.0	-48.7	0.7461	0.3660	0.3801	-1.2	A
24.6	75.0	-48.4	0.7498	0.3698	0.3800	5.1	A
23.2	76.0	-47.6	0.7494	0.3724	0.3770	9.9	A
22.0	77.0	-46.8	0.7447	0.3710	0.3737	9.9	A
20.9	78.0	-46.4	0.7409	0.3690	0.3719	4.1	A
19.6	79.0	-46.7	0.7438	0.3715	0.3723	-4.2	A
18.4	80.0	-47.6	0.7528	0.3792	0.3736	-9.2	A
17.4	81.0	-47.9	0.7633	0.3863	0.3770	-11.6	A
16.3	82.0	+47.4	0.7692	0.3910	0.3782	-7.5	A
15.4	83.0	-46.2	0.7714	0.3909	0.3804	1.3	A
14.5	84.0	-44.8	0.7697	0.3914	0.3783	12.7	A
13.5	85.0	-43.6	0.7691	0.3931	0.3760	23.8	A
12.5	86.0	-42.9	0.7667	0.3968	0.3699	26.4	A
11.8	87.0	-42.0	0.7629	0.3970	0.3659	21.3	A
11.2	88.0	-40.5	0.7595	0.3948	0.3647	-0.2	A
10.5	89.0	-39.6	0.7616	0.3962	0.3654	-20.7	A
9.9	90.0	-39.3	0.7723	0.4019	0.3703	-21.7	A
9.2	91.0	-39.6	0.7846	0.4100	0.3745	-9.9	A
8.6	92.0	-40.0	0.7914	0.4193	0.3721	0.7	A
8.0	93.0	-40.5	0.7990	0.4292	0.3698	-6.1	A
7.3	94.0	-40.2	0.8116	0.4392	0.3724	-32.6	A
6.7	95.0	-39.6	0.8274	0.4496	0.3778	-51.0	A
6.1	96.0	-38.7	0.8461	0.4602	0.3859	-79.4	A

1FILTERED RADIOMETERSONDE RUN FOR PHS 7 SEP 1973 OPUS 26

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
951.1	0.0	61.0	1.0167	0.7525	0.2642	0.0	9.521	23
920.2	1.0	32.8	1.0365	0.7892	0.2473	3.2	13.871	40
890.3	2.0	29.7	1.0419	0.8104	0.2315	-3.5	12.105	41
861.1	3.0	27.3	1.0413	0.8212	0.2201	0.7	10.915	41
833.4	4.0	25.4	1.0440	0.8199	0.2240	-0.2	9.790	40
813.3	5.0	23.6	1.0485	0.8148	0.2337	0.0	8.960	39
786.9	6.0	21.5	1.0395	0.8104	0.2291	1.0	8.454	41
760.5	7.0	19.3	1.0225	0.8050	0.2175	1.3	7.932	43
734.6	8.0	17.0	1.0113	0.7994	0.2119	0.6	7.185	43
715.5	9.0	14.4	1.0058	0.7902	0.2157	-0.2	6.206	43
690.6	10.0	12.4	0.9899	0.7731	0.2168	-0.6	5.440	43
667.7	11.0	9.8	0.9760	0.7574	0.2185	-0.5	5.788	47
646.0	12.0	6.9	0.9666	0.7444	0.2222	-0.9	4.836	52
623.7	13.0	4.9	0.9563	0.7332	0.2231	-1.5	2.764	33
602.5	14.0	4.5	0.9441	0.7127	0.2314	-2.2	2.793	30
582.8	15.0	3.7	0.9405	0.6997	0.2408	-2.4	2.570	30
563.8	16.0	1.8	0.9423	0.6913	0.2510	-1.9	2.328	30
544.0	17.0	-0.4	0.9396	0.6859	0.2537	-1.2	2.109	30
523.9	18.0	-2.9	0.9320	0.6756	0.2565	-0.6	1.773	30
505.4	19.0	-5.4	0.9251	0.6666	0.2585	-0.9	1.544	30
488.9	20.0	-7.4	0.9132	0.6543	0.2589	-1.7	1.365	30
472.5	21.0	-9.4	0.9020	0.6359	0.2660	-2.7	1.228	31
455.4	22.0	-11.6	0.8930	0.6161	0.2769	-3.3	1.101	32
439.0	23.0	-14.0	0.8921	0.6039	0.2882	-3.0	0.941	31
423.9	24.0	-16.1	0.8932	0.5995	0.2937	-2.2	0.782	30
408.9	25.0	-17.8	0.8924	0.5946	0.2977	-1.8	0.715	30
394.2	26.0	-19.4	0.8888	0.5879	0.3009	-2.3	0.636	30
379.8	27.0	-21.2	0.8880	0.5812	0.3068	-3.1	0.565	30
366.2	28.0	-23.0	0.8903	0.5734	0.3169	-3.6	0.499	30
353.0	29.0	-24.9	0.8854	0.5586	0.3268	-2.9	0.437	30
339.7	30.0	-26.7	0.8751	0.5430	0.3321	-1.3	0.297	23
326.3	31.0	-28.5	0.8642	0.5320	0.3322	-0.3	0.268	23
312.7	32.0	-30.2	0.8576	0.5293	0.3283	-0.6	0.234	23
300.4	33.0	-32.1	0.8543	0.5225	0.3318	-2.0	0.201	23
288.7	34.0	-34.3	0.8463	0.5072	0.3391	-2.8	0.170	23
277.1	35.0	-36.6	0.8363	0.4885	0.3479	-2.0	0.141	23
264.9	36.0	-38.9	0.8293	0.4808	0.3486	-0.4	0.120	23
253.3	37.0	-41.1	0.8299	0.4830	0.3468	1.5	0.098	23
241.6	38.0	-43.5	0.8334	0.4902	0.3432	1.8	0.083	24
230.3	39.0	-45.5	0.8287	0.4932	0.3355	0.2	0.069	24
219.9	40.0	-47.5	0.8203	0.4833	0.3370	-3.2	0.059	24
211.2	41.0	-49.5	0.8102	0.4616	0.3485	-5.7	0.050	24
202.8	42.0	-51.6	0.8026	0.4394	0.3632	-4.7		A
193.9	43.0	-53.7	0.7989	0.4331	0.3658	-2.4		A
184.1	44.0	-55.9	0.7963	0.4322	0.3641	-1.5		A
173.9	45.0	-58.2	0.7937	0.4266	0.3671	-1.5		A
164.2	46.0	-60.2	0.7919	0.4168	0.3751	-0.1		A
154.9	47.0	-61.8	0.7864	0.4135	0.3730	2.4		A
145.8	48.0	-63.4	0.7806	0.4184	0.3622	3.3		A
137.3	49.0	-65.3	0.7762	0.4217	0.3545	2.0		A
129.8	50.0	-67.2	0.7738	0.4138	0.3599	0.7		A
123.0	51.0	-69.1	0.7708	0.4100	0.3608	0.6		A
116.2	52.0	-71.0	0.7661	0.4115	0.3547	0.7		A
108.3	53.0	-72.3	0.7658	0.4121	0.3538	-1.2		A
101.0	54.0	-72.7	0.7700	0.4105	0.3593	-3.7		A
94.8	55.0	-71.5	0.7738	0.4079	0.3659	-5.2		A
89.7	56.0	-69.4	0.7750	0.4053	0.3697	-6.0		A
84.4	57.0	-67.4	0.7782	0.4032	0.3750	-4.9		A
79.4	58.0	-66.2	0.7843	0.4030	0.3813	-3.5		A
74.7	59.0	-64.3	0.7819	0.4005	0.3814	.4		A
70.2	60.0	-62.7	0.7809	0.3999	0.3810	6.4		A

65.9	61.0	-62.1	0.7809	0.4072	0.3738	12.1		A
61.9	62.0	-61.9	0.7860	0.4246	0.3614	14.9		A
58.3	63.0	-61.7	0.7951	0.4460	0.3491	11.8		A
55.0	64.0	-61.6	0.8024	0.4573	0.3452	3.6		A
51.8	65.0	-61.0	0.7957	0.4491	0.3466	-3.0		A
48.7	66.0	-58.8	0.7803	0.4277	0.3526	-2.0		A
45.9	67.0	-56.1	0.7711	0.4177	0.3534	4.2		A
43.1	68.0	-54.1	0.7676	0.4208	0.3468	8.3		A
40.4	69.0	-53.0	0.7687	0.4294	0.3393	3.2		A
37.8	70.0	-52.4	0.7691	0.4289	0.3403	-3.9		A
35.5	71.0	-51.9	0.7712	0.4215	0.3496	-8.5		A
33.3	72.0	-51.6	0.7728	0.4230	0.3498	-7.6		A
31.0	73.0	-51.4	0.7766	0.4254	0.3512	-2.7		A
28.6	74.0	-51.3	0.7818	0.4275	0.3543	-0.1		A
26.7	75.0	-51.1	0.7876	0.4351	0.3524	-0.2		A
25.4	76.0	-50.4	0.7982	0.4490	0.3493	-4.7		A
24.2	77.0	-49.1	0.8163	0.4624	0.3540	-1.4		A
23.1	78.0	-47.7	0.8390	0.4801	0.3589	21.2		A
21.7	79.0	-46.8	0.8571	0.5081	0.3490	44.5		A
20.5	80.0	-46.2	0.8696	0.5404	0.3292	48.4		A
19.3	81.0	-45.7	0.8779	0.5567	0.3211	23.1		A
18.1	82.0	-45.3	0.8845	0.5623	0.3222	-5.1		A
16.9	83.0	-44.9	0.8916	0.5629	0.3287	-18.2		A
15.9	84.0	-44.5	0.8994	0.5690	0.3304	-23.9		A
15.2	85.0	-43.9	0.9061	0.5730	0.3331	-37.4		A
14.4	86.0	-43.0	0.9089	0.5704	0.3386	-53.3		A
13.6	87.0	-42.0	0.9118	0.5613	0.3504	-31.1		A
12.9	88.0	-41.3	0.9152	0.5590	0.3562	28.4		A
12.2	89.0	-41.0	0.9185	0.5743	0.3441	69.6		A
11.4	90.0	-40.9	0.9190	0.5952	0.3238	41.3		A
10.6	91.0	-40.8	0.9212	0.5989	0.3223	-41.9		A
9.8	92.0	-40.7	0.9278	0.5873	0.3404	-118.2		A
9.1	93.0	-40.4	0.9349	0.5709	0.3640	-126.6		A
8.2	94.0	-40.0	0.9388	0.5575	0.3814	-102.5		A
7.4	95.0	-39.4	0.9411	0.5510	0.3901	-78.5		A
6.4	96.0	-38.8	0.9453	0.5421	0.4032	-80.1		A
6.0	96.4	-38.5	0.9471	0.5385	0.4086	-77.5		A

1FILTERED RADIOMETERSONDE RUN FOR SLE 18 JAN 1974 OPUS 27

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
996.1	0.0	17.7	0.7249	0.6607	0.0642	0.0	10.014	80
974.8	1.0	18.3	0.7304	0.6326	0.0978	-9.3	9.585	66
953.9	2.0	18.4	0.7459	0.6323	0.1136	-5.0	8.153	59
933.7	3.0	17.3	0.7575	0.6296	0.1279	-3.4	7.974	60
913.4	4.0	16.8	0.7603	0.6223	0.1380	-2.9	7.445	56
892.9	5.0	16.6	0.7575	0.6130	0.1445	-1.9	6.928	52

1FILTERED RADIOMETERSONDE RUN FOR SLC 18 JAN 1974 OPUS 28

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
994.7	0.0	15.1	0.6080	0.5532	0.0549	0.0	8.939	82
967.3	1.2	16.3	0.6412	0.5880	0.0532	0.4	8.020	66
943.4	2.2	16.5	0.6504	0.5768	0.0737	-2.8	9.284	74
918.7	3.2	16.0	0.6560	0.5661	0.0899	-2.5	10.254	82
892.5	4.2	15.0	0.6533	0.5575	0.0958	-1.1	10.417	87
868.1	5.2	13.5	0.6478	0.5533	0.0944	-0.2	10.214	90
845.8	6.2	11.8	0.6400	0.5459	0.0941	-0.1	9.146	89
824.0	7.2	9.9	0.6321	0.5364	0.0957	-0.2	8.245	87
802.0	8.2	8.9	0.6218	0.5254	0.0965	-0.1	7.403	86
780.0	9.2	7.6	0.6135	0.5174	0.0962	0.0	7.538	85
757.9	10.2	5.9	0.6071	0.5115	0.0956	0.0	6.273	84
736.2	11.2	3.7	0.6039	0.5080	0.0959	0.9	5.676	83
714.8	12.2	2.7	0.5985	0.5025	0.0959	2.9	5.253	82
694.1	13.2	1.7	0.5897	0.5095	0.0803	5.1	5.221	82
673.9	14.2	0.3	0.5802	0.5286	0.0516	4.7	4.915	84
655.3	15.2	-1.3	0.5807	0.5508	0.0299	0.6	4.328	81
637.7	16.2	-2.5	0.5937	0.5497	0.0440	-5.2	3.880	78
621.5	17.2	-3.8	0.6036	0.5283	0.0753	-8.5	3.455	73
604.1	18.2	-5.8	0.6001	0.4945	0.1056	-7.3	2.599	61
585.4	19.2	-7.7	0.5911	0.4670	0.1241	-4.6	1.145	32
565.9	20.2	-9.3	0.5743	0.4425	0.1318	-2.7	0.963	28
548.3	21.2	-10.5	0.5568	0.4214	0.1354	-2.7	0.815	26
531.5	22.2	-11.8	0.5483	0.4066	0.1418	-3.3	0.732	25
515.4	23.2	-12.7	0.5523	0.3928	0.1595	-3.6	0.674	24
499.8	24.2	-14.0	0.5499	0.3842	0.1657	-2.6		M
485.2	25.2	-15.8	0.5476	0.3756	0.1720	-1.4	0.025	1
469.6	26.2	-17.6	0.5405	0.3712	0.1693	-0.7	0.064	3
453.4	27.2	-19.3	0.5390	0.3625	0.1764	0.5	0.095	5
436.1	28.2	-21.2	0.5316	0.3593	0.1723	2.2	0.022	1
421.5	29.2	-23.3	0.5213	0.3573	0.1640	4.3		M
409.1	30.2	-24.9	0.5005	0.3531	0.1474	5.0	0.024	2
398.3	31.2	-26.1	0.4886	0.3500	0.1386	4.4	0.025	2
385.8	32.2	-27.8	0.4805	0.3478	0.1327	2.7	0.019	2
373.1	33.2	-29.7	0.4723	0.3453	0.1270	1.6	0.013	2
360.0	34.2	-31.4	0.4654	0.3412	0.1241	0.9	0.019	2
346.9	35.2	-33.2	0.4603	0.3353	0.1250	1.3		M
334.2	36.2	-35.2	0.4518	0.3281	0.1237	2.5	0.024	4
321.7	37.2	-37.3	0.4370	0.3239	0.1131	3.0	0.030	6
310.5	38.2	-39.5	0.4250	0.3213	0.1038	2.6	0.043	10
299.4	39.2	-41.7	0.4190	0.3144	0.1046	1.4	0.045	14
288.3	40.2	-43.9	0.4083	0.3051	0.1032	0.1	0.048	17
277.1	41.2	-46.1	0.3947	0.2943	0.1004	-0.2	0.043	19
266.9	42.2	-48.4	0.3880	0.2834	0.1046	-1.5	0.036	20
257.0	43.2	-50.7	0.3757	0.2702	0.1055	-4.2		A
247.0	44.2	-52.9	0.3687	0.2552	0.1134	-7.3		A
236.9	45.2	-55.1	0.3723	0.2403	0.1320	-8.6		A
227.1	46.2	-57.1	0.3841	0.2308	0.1533	-7.5		A
218.0	47.2	-58.9	0.3830	0.2259	0.1571	-6.4		A
210.3	48.2	-60.1	0.3809	0.2206	0.1603	-6.2		A
202.4	49.2	-60.4	0.3849	0.2100	0.1750	-8.1		A
194.5	50.2	-60.1	0.3902	0.2029	0.1873	-8.8		A
186.8	51.2	-60.1	0.3985	0.2014	0.1971	-8.6		A
180.0	52.2	-60.6	0.4074	0.2015	0.2060	-10.0		A
172.9	53.2	-61.1	0.4155	0.1958	0.2197	-12.0		A
166.3	54.2	-60.8	0.4210	0.1853	0.2357	-11.7		A
159.6	55.2	-60.0	0.4273	0.1756	0.2518	-8.0		A
153.5	56.2	-59.8	0.4295	0.1729	0.2566	-2.1		A
147.7	57.2	-60.6	0.4263	0.1742	0.2522	1.9		A
141.9	58.2	-61.6	0.4196	0.1733	0.2463	1.9		A
136.4	59.2	-62.6	0.4191	0.1719	0.2472	-3.5		A
131.7	60.2	-62.9	0.4235	0.1730	0.2505	-8.5		A

127.1	61.2	-62.7	0.4346	0.1690	0.2655	-8.1	A
121.9	62.2	-62.5	0.4384	0.1659	0.2725	-2.1	A
117.3	63.2	-62.4	0.4313	0.1622	0.2691	7.2	A
112.7	64.2	-62.3	0.4183	0.1610	0.2573	11.6	A
108.3	65.2	-62.6	0.4071	0.1625	0.2446	10.4	A
103.9	66.2	-63.8	0.4075	0.1671	0.2404	5.5	A
100.1	67.2	-64.9	0.4102	0.1706	0.2395	0.4	A
96.1	68.2	-65.8	0.4129	0.1725	0.2404	-1.9	A
92.0	69.2	-66.0	0.4149	0.1717	0.2432	-2.7	A
88.1	70.2	-65.6	0.4148	0.1699	0.2449	-2.7	A
84.6	71.2	-64.4	0.4152	0.1691	0.2461	-4.1	A
81.3	72.2	-63.6	0.4207	0.1732	0.2475	-8.4	A
78.1	73.2	-63.6	0.4313	0.1775	0.2539	-14.6	A
75.0	74.2	-63.9	0.4394	0.1751	0.2643	-21.9	A
72.1	75.2	-64.3	0.4465	0.1698	0.2767	-31.5	A
69.3	76.2	-64.6	0.4541	0.1622	0.2919	-44.2	A
66.6	77.2	-64.8	0.4737	0.1571	0.3166	-53.4	A
64.0	78.2	-65.0	0.4992	0.1511	0.3480	-70.3	A

```
         LSTECHR.    75/08/29.NOAA    KRONOS L8.3.1  75/08/21.

15.36.29.LSTEAR(X)
15.36.29.ACCOUNT(LPB)
15.36.30.CHARGE(RC,RDJ44014)
15.36.31.COPYSBF.
15.36.35. COPY COMPLETE.
15.36.35.CR         1.395 KCD.   $      1.894
15.36.35.CP         0.869 SEC.
15.36.35.CM         0.129 BDL.   $      0.193
15.36.35.MS        32.768 KWD.   $      0.196
15.36.35.    TOTAL =             $      2.283
15.48.35.LQ16       0.031 KPG.   $      1.239
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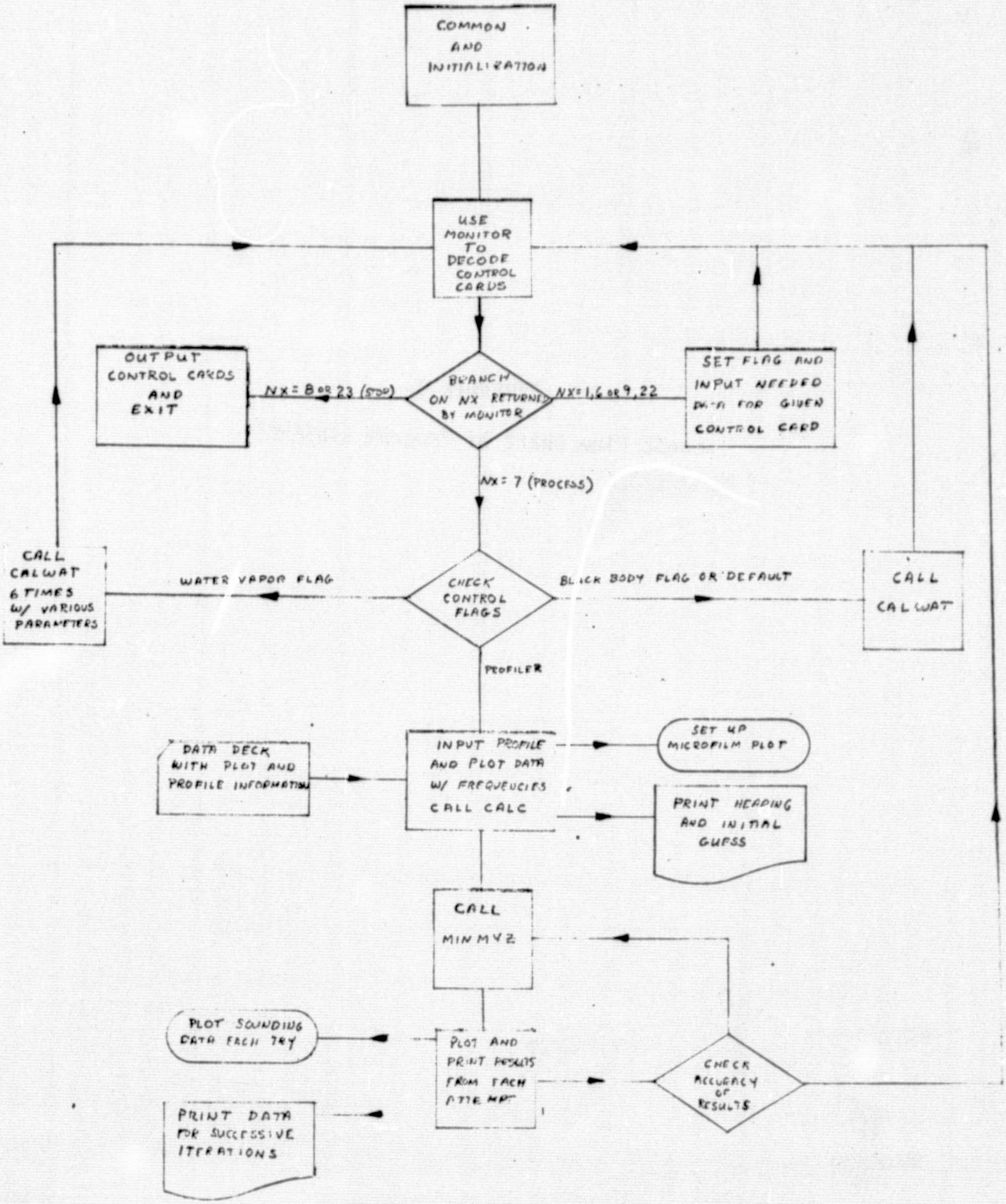
**ORIGINAL PAGE IS
OF POOR QUALITY**

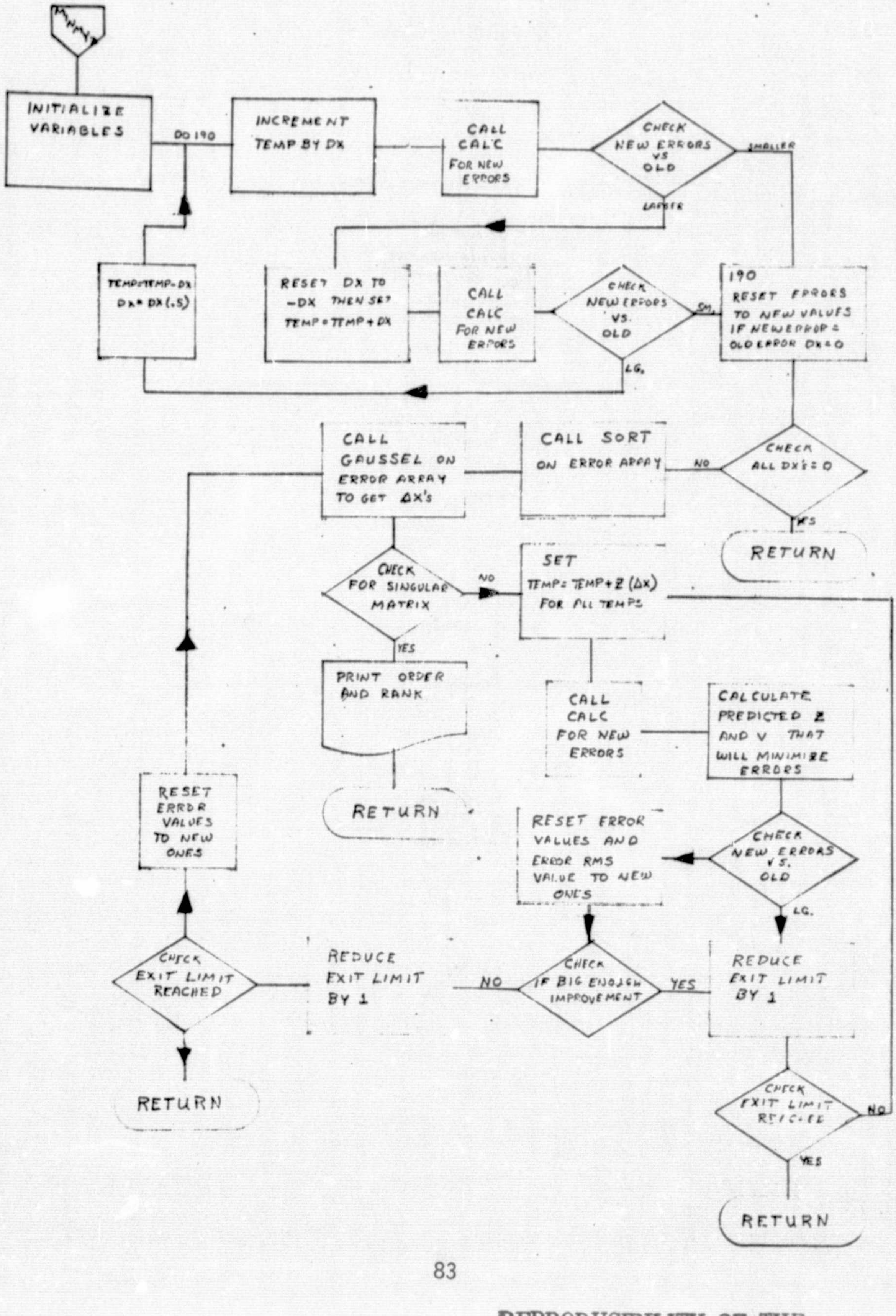
APPENDIX C

Logic Flow Chart of Program RADIANCE

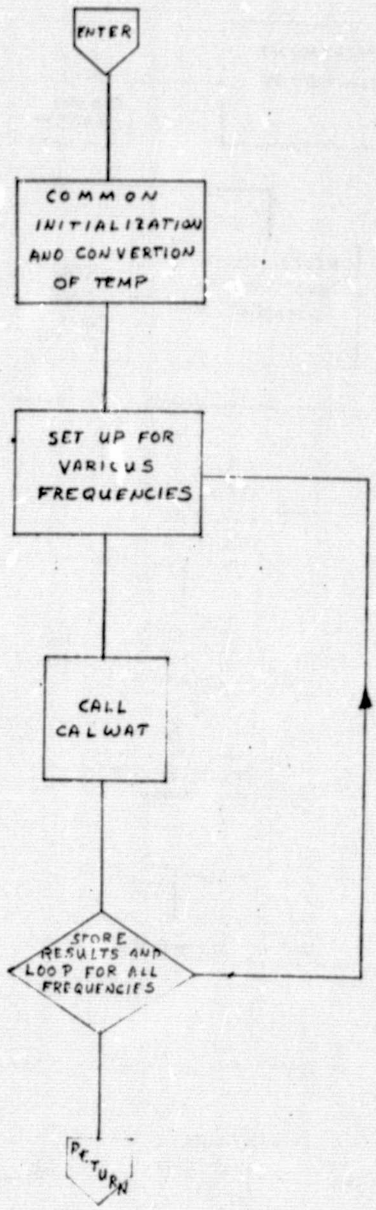
RADIANCE


COMMON AND INITIALIZATION
USE MONITOR TO DECODE CONTROL CARDS
OUTPUT CONTROL CARDS AND EXIT
NX = 8 OR 23 (STOP)
BRANCH ON NX RETURNED BY MONITOR
NX = 1, 6 OR 9, 22
SET FLAG AND INPUT NEEDED DATA FOR GIVEN CONTROL CARD
NX = 7 (PROCESS)
CALL CALWAT 6 TIMES W/ VARIOUS PARAMETERS
WATER VAPOR FLAG
CHECK CONTROL FLAGS
BLACK BODY FLAG OR DEFAULT
CALL CALWAT
PROFILER
DATA DECK WITH PLOT AND PROFILE INFORMATION
INPUT PROFILE AND PLOT DATA W/ FREQUENCIES CALL CALC
SET UP MICROFILM PLOT
PRINT HEADING AND INITIAL GUESS
CALL MINMYZ
PLOT SOUNDING DATA EACH TRY
PLOT AND PRINT RESULTS FROM EACH ATTEMPT
CHECK ACCURACY OF RESULTS
PRINT DATA FOR SUCCESSIVE ITERATIONS

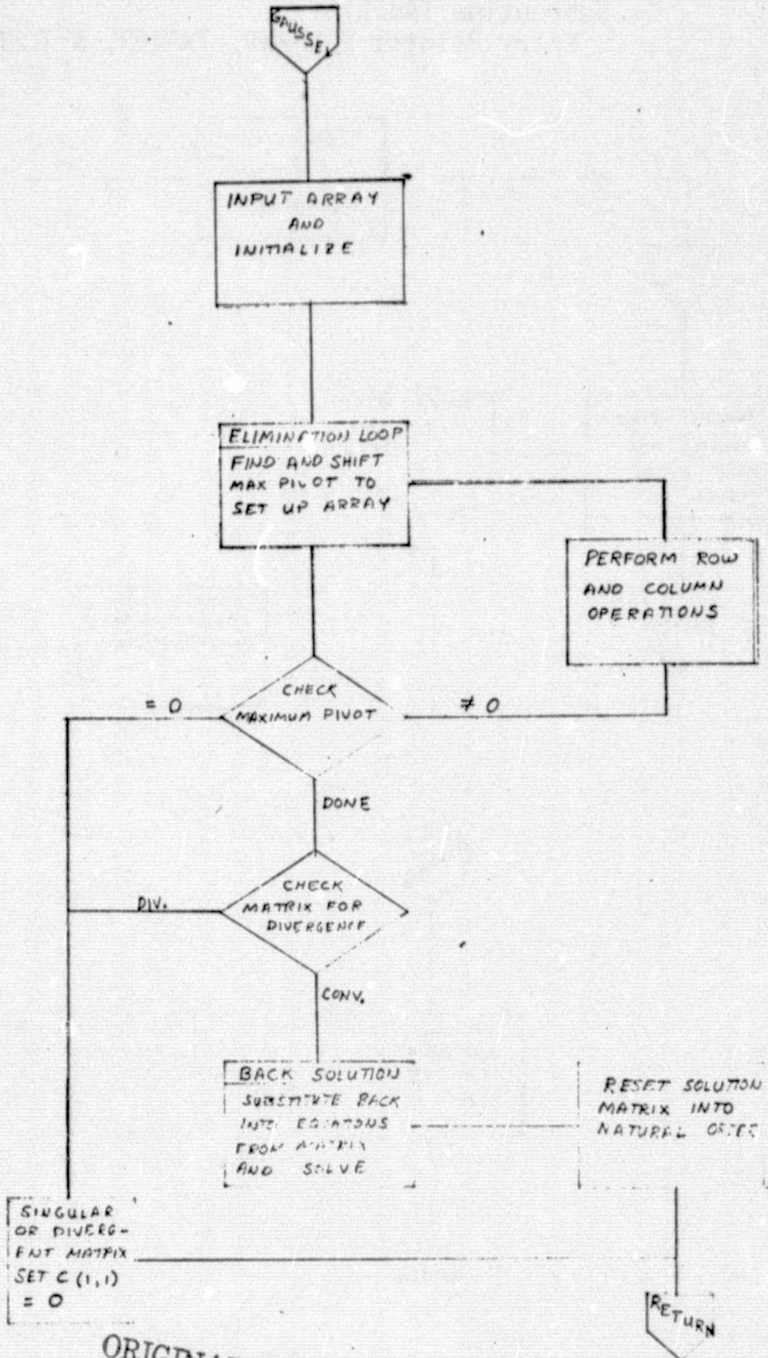
Subroutine MINMYZ



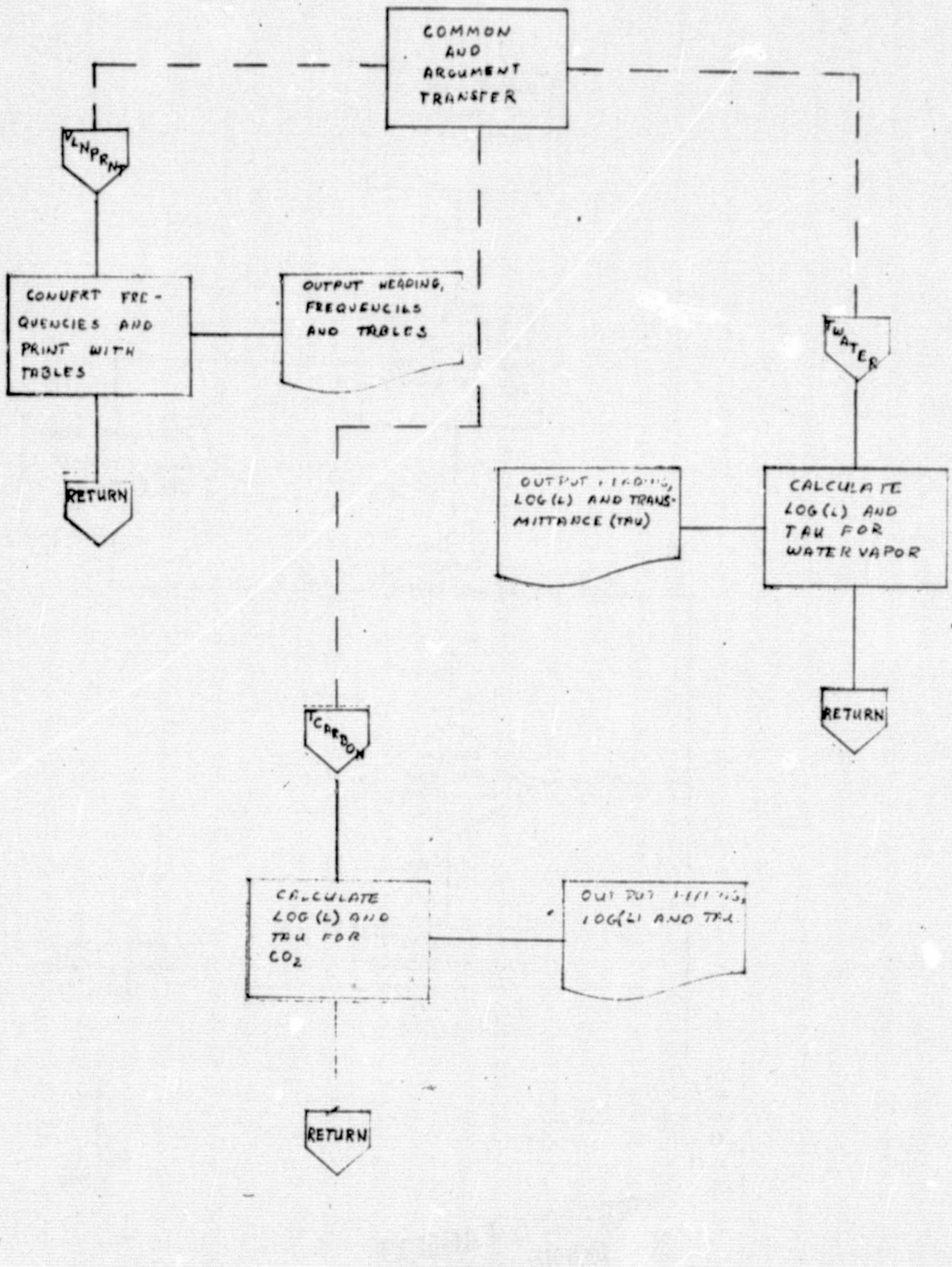
Subroutine CALC



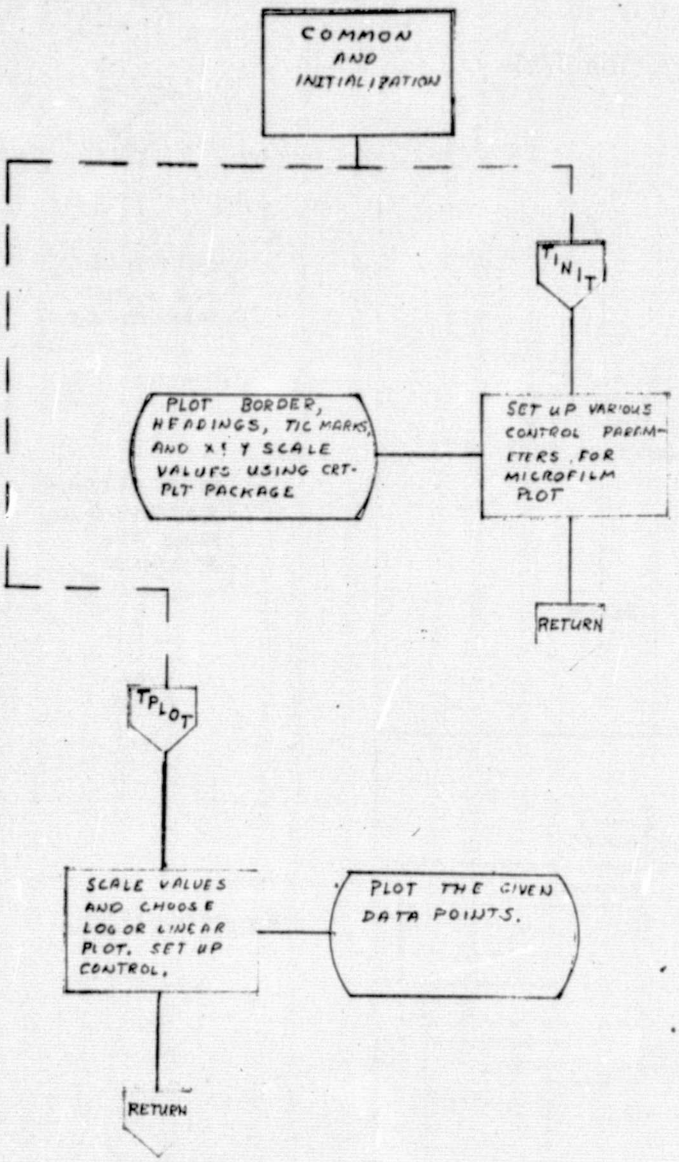
Subroutine GAUSSEL



Subroutine TABPRINT
Entry Points: VLNPRNT, TWATER, & TCARBON

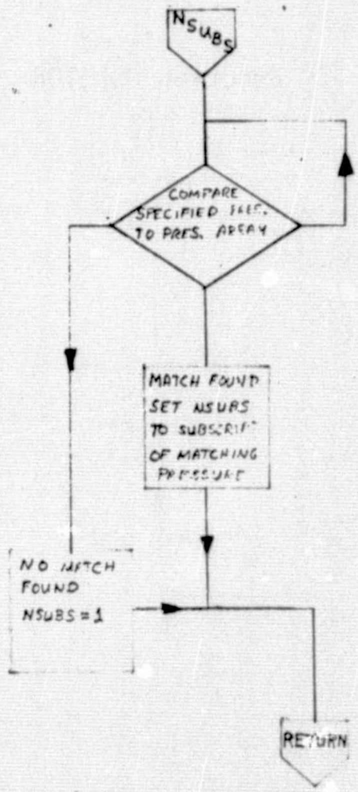


Subroutine PTPLOT
Entry Points: TINIT & TPLOT

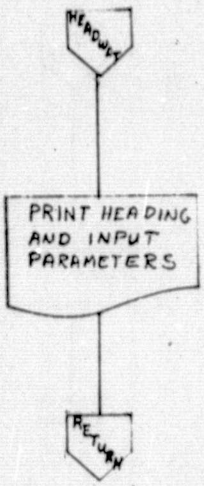


Subroutine SORT

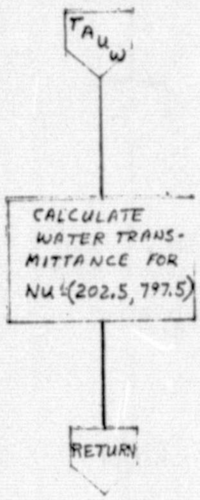
Function NSUBS



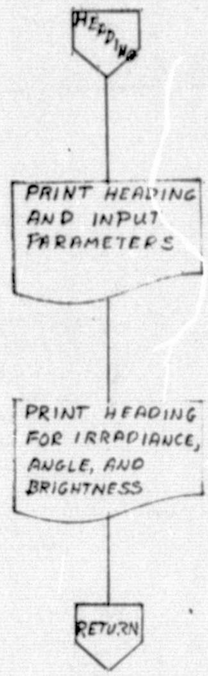
Subroutine HEADWAT



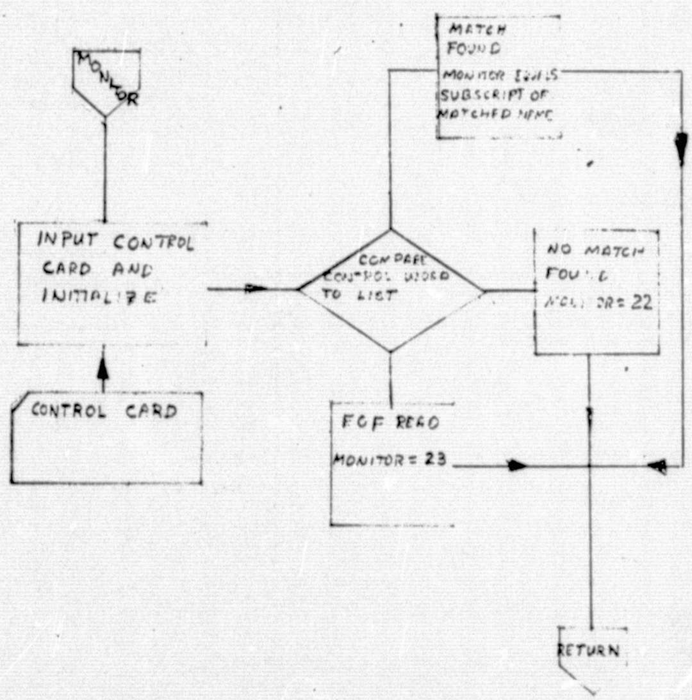
Function TAUW



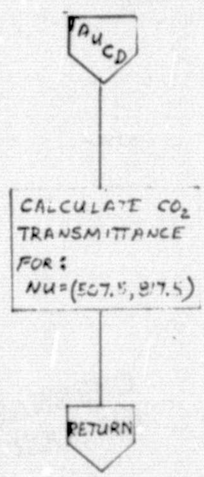
Subroutine HEADING



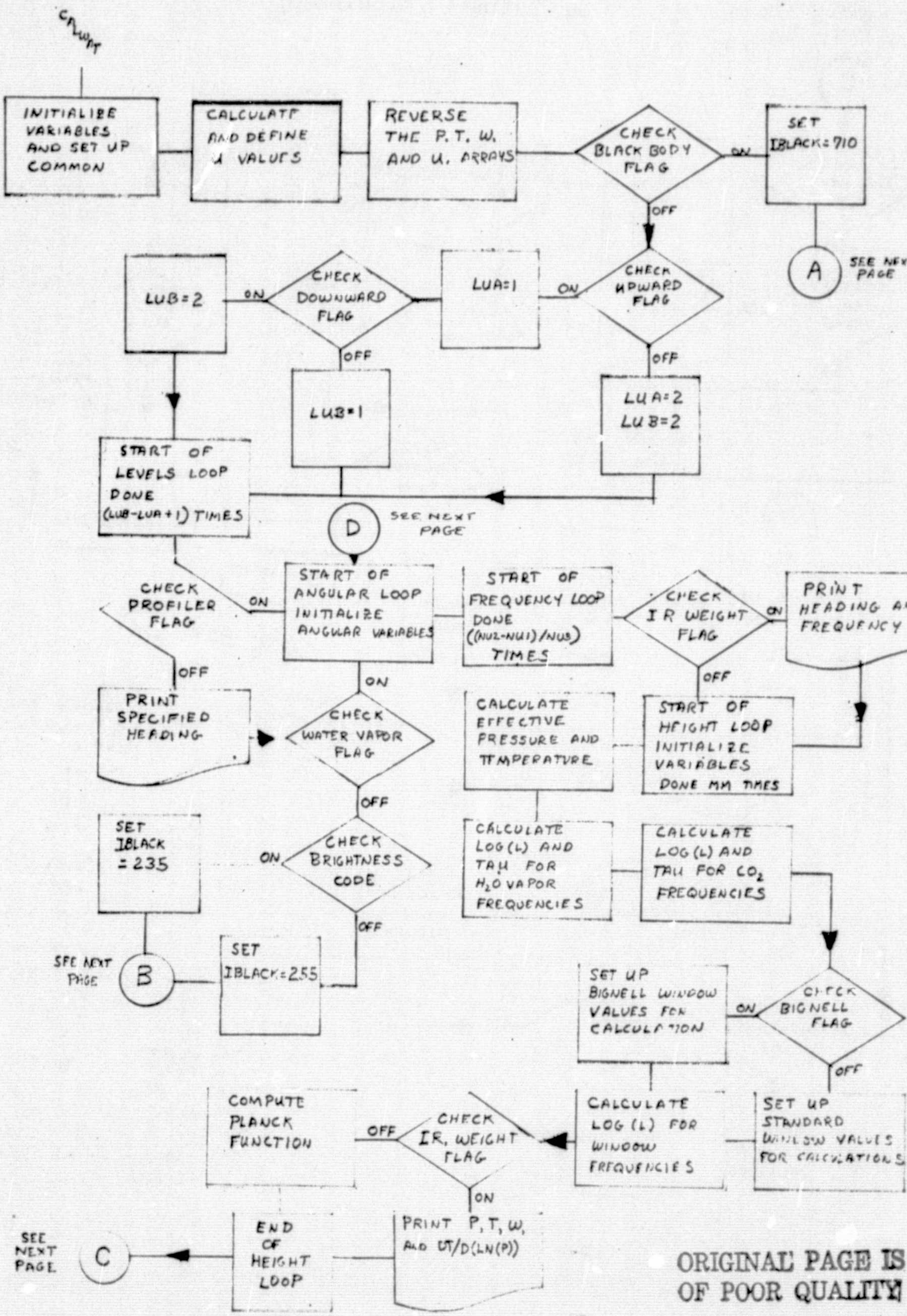
Function MONITOR



Function TAUCD



Subroutine CALWAT



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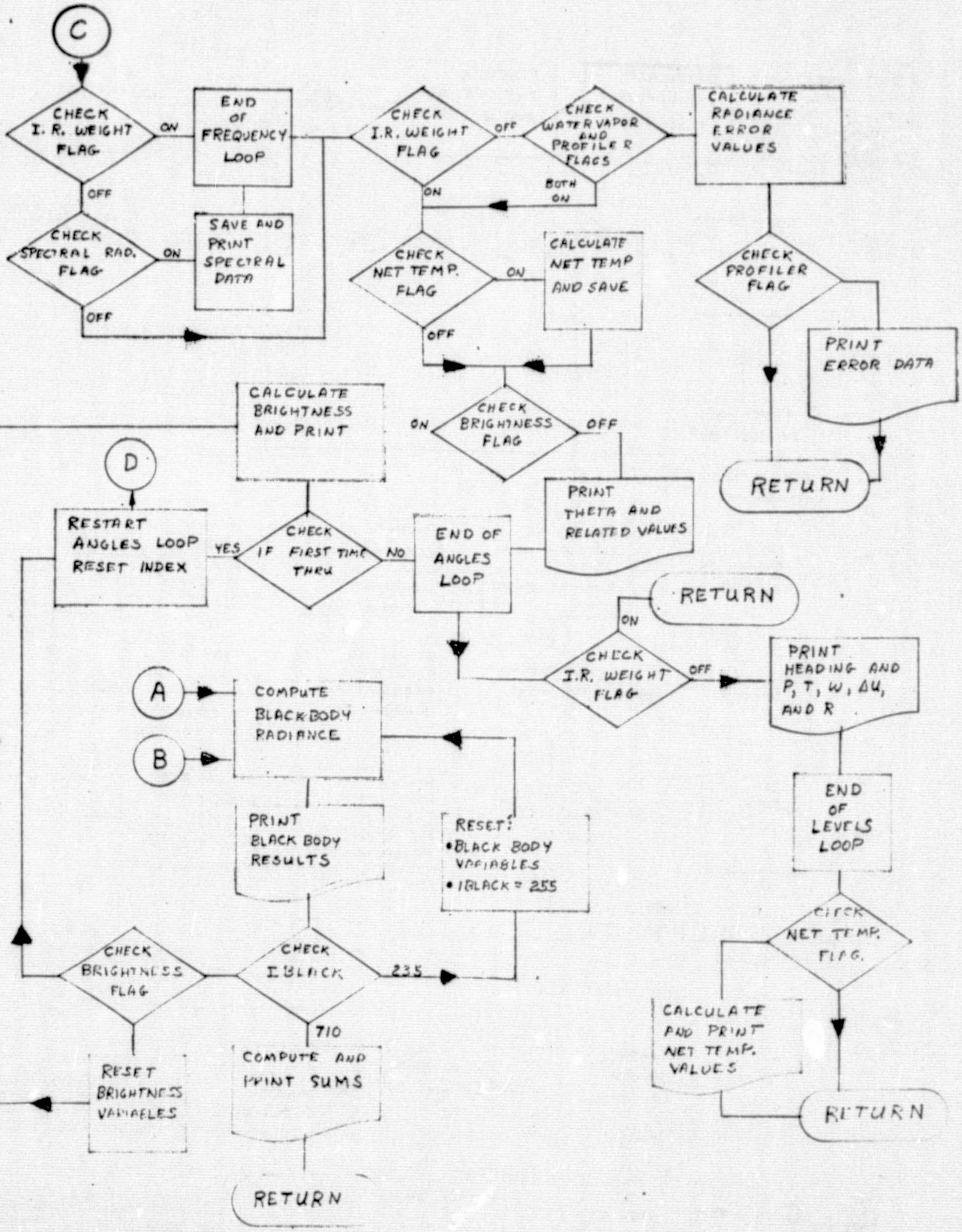
Subroutine CALWAT (cont.)



APPENDIX D

Program RADIANCE Listing

```
      PROGRAM RADIANC (INPUT, OUTPUT, PUNCH,TAPE10,TAPE60=INPUT)
C*****************************************************************************
C
C                                         RADIANCE PROGRAM
C                                UPWARD OR DOWNWARD RADIANT POWER
C                                BLACK BODY CALIBRATION
C                                USES BILL SMITH AND/OR OLD TABLES
C                                WATER VAPOR ADDED DEC. 28, 1973
C                                PROFILER ADDED JANUARY, 1974
C
C*****************************************************************************
      COMMON W (200, 2), PH (200, 2), T (200, 2), TO (200, 2)
      COMMON DELUC(200,2), DDELU(200,2), DELUOZ(200,2)
      COMMON XXDELU(200), XDELUC(200), XDELOZ(200)
      COMMON SECT (3), AIII (3), W C (3), THETA (3)
      COMMON INFLAG (30), NAMES (30), INPUT (10)
      COMMON TTB (2), XWW (2), XPP (2), XTT (2)
      COMMON IFMT (9)
C
      DIMENSION IHD (2, 4)
      DIMENSION WSS (200)
C
      COMMON/PTW/XP(200),XT(200),XW(200),TA(200)
      COMMON /HEAD /ISTA, MDATE, NDATE, WL1, TWL2, IF1, IF2, FNU1, FNU2,
     1 NPAGE, DNU, NPTW, IBRITE
      COMMON /XYZW /WX, WY, WZ, CW (9, 120)
      COMMON /XYZ /DD, DY, DZ, CCD (9, 63)
      COMMON /ALFLIR /AL (229), FLTR (229), DUMMY2
      COMMON /ALCALW/ ALC(229),ALW(229),ALOZ(229),OZMXR(19),OZPRS(19)
      COMMON /TRANS /IWAI, TWAD, NTWA, TT (50), TCOI, TCOD, NTCO, ITC (7
     14),TOZI,TOZD,NTOZ,TTOZ(41)
      COMMON /XWT /X (3), WT (3), XK1 (6), XK2 (6), BBODY (75)
      COMMON /PARAMT /M, NANGLES, NU1, NU2, NU3, MK, LUOD, NCOSW, P, Q,
     1PI,LUR,NOZSW
      COMMON /WATERP /RNOBS, FZW, H2T, VLAMB
      COMMON /DATT /NCA, NCB, NWA, NWB, IPP, ISPRAD, IWINDT, NPAER, PLOW
     1, PHIGH, CKNRG, ALO, ZERO, CC22, PUP, PDO, NKORS, LCON, LEVELS, IR
     2WAIT, NBBRAD, LEVUP, LEVDO, TI, TD, TF, NLINES
C
C
      DIMENSION NNN(6)
      EQUIVALENCE (TWAI, TWII), (TWAD, TWID), (NTWA, NTWI)
C
      DATA(NNN=0,0,0,-1,-1,-1)
      DATA (WT = .5555555556, .8888888889, .5555555556)
      DATA (X = - .7745966692, .0, .7745966692)
      DATA (DEGTRAD = .017453293), (PI = 3.14159265)
      DATA (ZERO = 0.)
      DATA (P = 3.7413E-12), (Q = 1.4389)
      DATA (XK1 = .18, .12, .09, .08, .07, .07), (XK2 = 25., 19., 10., 1
     10., 12., 27.)
      DATA(IHD=8H  WATER ,5HVAPOR,7H CARBON,7HDIOXIDE,8H     WIN,
     1 3HDOW,8H      FIL,3HTER)
      DATA (EPS = 5.E-8)
      DATA (A = 357.9110836), (D0 = - 1.226463094E+4), (D1 = - 6.4702158
     142E+1), (D2 = 2.171276986E-1), (D3 = - 1.317730402E-4)
      IDATE(1)=8HDD/MM/YY
```

```
      CALL SYSTEMC(30,NNN)
      NCA = 560
      NCB = 810
      NWA = 680
      NWB = 1200
      RSG = 2.87E+6 / 980.
      NDATE = IDATE (XDUMMY)
 1500 FORMAT (10F8.2)
      NTWA = NTWA - 2
      NTCO = NTCO - 2
      NAMES (1) = 8HFREQUENC
      NAMES (2) = 6HANGLES
      NAMES (3) = 6HFILTER
      NAMES (4) = 3HCO2
      NAMES (5) = 6HUPWARD
      NAMES (6) = 8HDOWNWARD
      NAMES (7) = 7HPROCESS
      NAMES (8) = 4HSTOP
      NAMES (9) = 6HBB CALIB
      NAMES (10) = 8HPTW DATA
      NAMES (11) = 7HSTATION
      NAMES (12) = 8HSPECTRAL
      NAMES (13) = 8HIR WEIGH
      NAMES (14) = 8HBRIGHTNE
      NAMES (15) = 7HAEROSOL
      NAMES (16) = 7HBIGNELL
      NAMES (17) = 6HTABLES
      NAMES (18) = 8HNET TEMP
      NAMES (19) = 5HOZONE
      NAMES (20) = 8HWATER VA
      NAMES (21) = 8HPROFILER
      IBRITE = 2
      ISPRAP = 2
      IPP = 1
      NCOSW = 1
      NOZSW=1
      IF1 = IF2 = IH
      NU1 = 0
      NU2 = 2280
      NU3 = 10
      ALO = 0
      AHI = 90.
      LEVUP = LEVDO = 1
      PUP = 1012.8
      PDO = .1
      WL1 = 1. / 2280.
      IWL2 = 8HINFINITY
      IWINDT = 1
      NPAER = 2
      NONAMES = 21
      NCARDS = 0
      IF (NONAMES .LT. 1) GO TO 465
      DO 100 I = 1, NONAMES
  100 INFLAG (I) = 0
  465 CONTINUE
C*****************************************************************************
C                                            READ CONTROL CARDS
```

```
C********************************************************************************
145   NX = MONITOR (NUNAMES, NAMES, INPUT, 60)
      NCARDS = NCARDS + 1
      WRITE (10, 1524) INPUT
      GO TO (200, 215, 230, 240, 2 5, 255, 315, 265, 275, 280, 300, 310,
     1 165, 170, 185, 195, 105, 14 , 150, 155, 160, 305, 265), NX
C---------------------------  FREQUENCIES  ---------------------------------
200   INFLAG (1) = 1
      DECODE (8, 1510, INPUT (3))NU1
      DECODE (8, 1510, INPUT (4))NU2
      DECODE (8, 1510, INPUT (5))NU3
1510  FORMAT (I8)
      IF (NU2 .EQ. 0) NU2 = 2280
      IF (NU3 .EQ. 0) NU3 = 10
      FNU1 = NU1
      FNU2 = NU2
      DNU = NU3
C*************************  DETERMINE WAVELENGTHS
      WL1 = 1.E4 / FNU2
      IF (FNU1 .EQ. 0.)205, 210
205   IWL2 = 8HINFINITY
      GO TO 145
210   WL2 = 1.E4 / FNU1
      ENCODE (8, 1512, IWL2)WL2
1512  FORMAT (F8.2)
      GO TO 145
C---------------------------  ANGLES  -------------------------------------
215   INFLAG (2) = 1
      DECODE (8, 1514, INPUT (2))ALO
      DECODE (8, 1514, INPUT (3))AHI
1514  FORMAT (F8.0)
      IF (AHI .EQ. 0.) GO TO 225
      IF (AHI .EQ. ALO) GO TO 225
      C1 = (AHI - ALO) * .5
      C2 = (AHI + ALO) * .5
      CC22 = PI * (SIN (DEGTRAD * (AHI - ALO))) * * 2
      DO 220 K = 1, 3
      THETA (K) = C1 * X (K) + C2
      Y = DEGTRAD * (THETA (K) - ALO)
      COSY = COS (Y)
      WSC (K) = WT (K) * SIN (Y) * COSY * C1 * .10966
220   SECT (K) = 1. / COS (DEGTRAD * THETA (K))
      NANGLES = 3
      GO TO 145
225   NANGLES = 1
      WSC (1) = .10966
      THETA (1) = ALO
      SECT (1) = 1. / COS (DEGTRAD * ALO)
      AIII (2) = AIII (3) = 0.
      GO TO 145
C---------------------------  FILTER  -------------------------------------
230   INFLAG (3) = 1
      IF1 = INPUT (2)
      IF2 = INPUT (3)
      CALL DUMMY5
      IF (INPUT (4) .EQ. 3HNEW)235, 145
235   READ 1500, FLTR
```

```
      CALL GLNPRNT (FLTR, IHD (1, 4))
      GO TO 145
C----------_--------------- CO2 _----------_------------------------
 240  INFLAG (4) = 1
      IF (INPUT (2) .EQ. 7HINCLUDE) NCOSW = 1
      IF (INPUT (2) .EQ. 7HEXCLUDE) NCOSW = 2
      GO TO 145
C----------_--------------- UPWARD --------_------------------------
 245  INFLAG (5) = 1
      IF (INPUT (2) .EQ. 5HBEGIN) DECODE (8, 1514, INPUT (3))PUP
      IF (INPUT (5) .EQ. 6HLEVELS) DECODE (8, 1510, INPUT (6))LEVUP
      IF (PUP .EQ. 0)250, 145
 250  INFLAG (5) = 0
      GO TO 145
C----------_--------------- DOWNWARD -----_------------------------
 255  INFLAG (6) = 1
      IF (INPUT (2) .EQ. 5HBEGIN) DECODE (8, 1514, INPUT (3))PDO
      IF (INPUT (5) .EQ. 6HLEVELS) DECODE (8, 1510, INPUT (6))LEVDO
      IF (PDO .EQ. 0)260, 145
 260  INFLAG (6) = 0
      GO TO 145
C----------_--------------- PROCESS -------_------------------------
 315  M = M
C**********_***************** SET UP TO PRINT INPUT PARAMETERS
      NLINES=0
      NPAGE = 1
      IF (INFLAG (9)  .EQ. 1) GO TO 330
      IF (INFLAG (20) .EQ. 1) GO TO 335
      IF (INFLAG (21) .EQ. 1) GO TO 360
      CALL CALWAT (X1, FX1, 2)
      GO TO 145
C**********_***************** BB CALIBRATE
 330  CALL CALWAT (X1, FX1, 2)
      GO TO 145
C**********_***************** WATER VAPOR LOOP
 335  X1 = .01
      DELX = .0001
      CALL CALWAT (X1, FX1, 1)
      CALL CALWAT (X1 + DELX, FX11, 2)
      FPX1 = (FX11 - FX1) / DELX
      X2 = X1 - FX1 / FPX1
 340  DI = X2 - X1
      IF (X2 .LE. .0000) GO TO 350
      CALL CALWAT (X2, FX2, 1)
      IF (ABS (FX2) - EPS)355, 355. 345
 345  CALL CALWAT (X2 + DELX, FX22, 2)
      FPX2 = (FX22 - FX2) / DELX
      AI = (2. * FPX2 + FPX1 - 3. * (FX2 - FX1) / DI) / DI
      UI = FX2 / FPX2
      X3 = X2 - UI * (1. + UI * AI / FPX2)
      X1 = X2
      FX1 = FX2
      X2 = X3
      FPX1 = FPX2
      GO TO 340
 350  PRINT 1530
1530  FORMAT (//*W IS LESS THAN OR EQUAL TO .0000*//)
```

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      CALL FALWAT (.001, FX1, 1)
      CALL FALWAT (.0025, FX1, 1)
      CALL FALWAT (.005, FX1, 1)
      CALL FALWAT (.0075, FX1, 1)
      CALL FALWAT (.025, FX1, 1)
      CALL FALWAT (.050, FX1, 1)
      GO TO 145
  355 T = TA (1)
      PR = XP (1)
      ESLN = A + D0 / T + D1 * ALOG (T) + (D3 * T + D2) * T
      ES = 10. * EXP (ESLN)
      WS = .622 * ES / (PR - ES)
      RH = X2 / WS * .1
      PRINT 1532, RH
 1532 FORMAT (///*  RELATIVE HUMIDITY = *,F7.2,* -*/)
      GO TO 145
C***************************** TEMPERATURE PROFILER
  360 CALL PROFILE(M,NPTW,ALO,NU3)
      GO TO 145
C---------------------------- STOP OR EOF  ---------------------------
  265 REWIND 10
      PRINT 1516
 1516 FORMAT (*1LIST OF INPUT CONTROL CARDS FOLLOWS*/)
      IF (NCARDS .LT. 1) GO TO 470                                       **
      DO 270 I = 1, NCARDS
      READ (10, 1524)INPUT
      PRINT 1518, INPUT
 1518 FORMAT (1X,10A8)
  270 CONTINUE
  470 CONTINUE                                                           **
 1520 FORMAT (1H )
      IF (INPUT (1) .EQ. 7HPROCESS) PRINT 1520
      PRINT 1522
 1522 FORMAT (*0END OF RUN*)
      CALL EXIT
C---------------------------- BB CALIBRATE  --------------------------
  275 INFLAG (9) = 1
      INFLAG (19) = INFLAG (20) = 0
      DECODE (8, 1514, INPUT (3))TI
      DECODE (8, 1514, INPUT (4))TF
      DECODE (8, 1514, INPUT (5))TO
      GO TO 145
C---------------------------- P T W DATA  ----------------------------
  280 INFLAG (10) = 1
      ENCODE(72,1524,IFMT)(INPUT(I),I=2,10)
      M = 0
  290 READ 1524, INPUT
 1524 FORMAT (10A8)
      NCARDS = NCARDS + 1
      WRITE (10, 1524)INPUT
      IF (INPUT (1) .EQ. 7HPTW END) GO TO 295
      M = M + 1
      ENCODE(80,1524,INPUT)INPUT
      DECODE (80, IFMT, INPUT)XP (M), XT (M), XW (M)
      TA (M) = XT (M) + 273.16
      T = TA (M)
      PR = XP (M)
```

```
      ESLN = A + D0 / T + D1 * ALOG (T) + (D3 * T + D2) * T
      ES = 10. * EXP (ESLN)
      WSS (M) = 622. * ES / (PR - ES)
      IF (WSS (M) .LT. 0.) WSS (M)  = 0.
      GO TO 290
  295 NPTW = M
C***************************** PRINT P T W DATA
      PRINT 1526, (XP (I), XT (I), XW (I), WSS (I), I = 1, NPTW)
 1526 FORMAT (1H1,5X,1HP,9X,1HT,9X,1HW,7X,*W SAT*/(2F10.2,2F10.4))
      GO TO 145
C----------------------------- STATION --------------------------------
  300 INFLAG (11) = 1
      ISTA = INPUT (2)
      MDATE = INPUT (3)
      GO TO 145
C----------------------------- SPECTRAL RADIANCE ----------------------
  310 ALO = 0.
      ISPRAD = 1
      GO TO 225
C----------------------------- IR WEIGHT -------------------------------
  165 IPP = 2
      INFLAG (13) = 1
      GO TO 145
C----------------------------- BRIGHTNESS TEMPERATURE ------------------
  170 INFLAG (14) = 1
      IF (INPUT (4) .EQ. 7HINCLUDE) 175, 180
  175 IBRITE = 1
      GO TO 145
  180 IBRITE = 2
      GO TO 145
C----------------------------- AEROSOL ---------------------------------
  185 INFLAG (15) = 1
      NPAER = 1
      ENCODE(32,3,INPUT(2))(INPUT(I),I=2,5)
    3 FORMAT(4A8)
      DECODE (32, 1508, INPUT (2))ABSK, PLOW, PHIGH
 1508 FORMAT (E8.2,3F8.1)
      IF (ABSK .EQ. 0.) GO TO 190
      CKNRG = ABSK * RSG
      GO TO 145
  190 INFLAG (15) = 0
      NPAER = 2
      GO TO 145
C----------------------------- BIGNELL WINDOW -------------------------
  195 INFLAG (16) = 1
      IWINDT = 2
      GO TO 145
C----------------------------- TABLES ----------------------------------
  105 INFLAG (17) = 1
      IF (INPUT (2) .NE. 4HLIST) GO TO 110
      CALL WLNPRNT (AL, IHD (1, 1))
      CALL WLNPRNT (ALC, IHD (1, 2))
      CALL WLNPRNT (ALW, IHD (1, 3))
      CALL WLNPRNT (FLTR, IHD (1, 4))
      CALL TWATER (A, B)
      CALL TCARBON (A, B)
      GO TO 145
```

```
  110 IF (INPUT (2) .EQ. 8HWATER VA)115, 120
  115 READ 1502, NA, NB
 1502 FORMAT (2I5)
      READ 1504, (AL (NN), NN = NA, NB)
 1504 FORMAT (10F8.2)
      CALL WLNPRNT (AL, IHD (1, 1))
      GO TO 145
  120 IF (INPUT (2) .EQ. 8HCARBON D)125, 130
  125 READ 1502, NA, NB
      READ 1504, (ALC (NN), NN = NA, NB)
      CALL WLNPRNT (ALC, IHD (1, 2))
      GO TO 145
  130 IF (INPUT (2) .EQ. 6HWINDOW)135, 305
  135 READ 1502, NA, NB
      READ 1504, (ALW (NN), NN = NA, NB)
      CALL WLNPRNT (ALW, IHD (1, 3))
      GO TO 145
C--------------------------- NET TEMPERATURE --------------------------
  140 INFLAG (18) = 1
      GO TO 145
C--------------------------- OZONE ------------------------------------
  150 INFLAG (19) = 1
      IF(INPUT(2).EQ.7HINCLUDE) NO3SW=1
      IF(INPUT(2).EQ.7HEXCLUDE) NO3SW=2
      GO TO 145
C--------------------------- WATER VAPOR ------------------------------
  155 INFLAG (19) = INFLAG (9) = 0
      INFLAG (20) = 1
      ENCODE(24,1,INPUT(3))INPUT(3),INPUT(4),INPUT(5)
    1 FORMAT(3A8)
      DECODE (24, 1506, INPUT (3))VLAMB, RNOBS
 1506 FORMAT (F8.0,F16.0)
      GO TO 145
C--------------------------- PROFILER ---------------------------------
  160 INFLAG (21) = 1
      INFLAG (9) = INFLAG (19) = INFLAG (20) = 0
      GO TO 145
C--------------------------- INCORRECT INPUT CONTROL ------------------
  305 PRINT 1528, INPUT
 1528 FORMAT (*0INCORRECT INPUT CONTROL*/1H0,10A8)
      GO TO 145
      END
```

```
      FUNCTION MONITOR (NX, NAMES, INPUT, LU)
C
C ///////////////////////////////////////////
C
C THIS FUNCTION READS ONE CARD FROM LOGICAL UNIT LU.   THE FIRST EIGHT
C COLUMNS CONTAIN A STRING OF 8 HOLLERITH CHARACTERS.   THIS STRING OF
C CHARACTERS IS COMPARED WITH THE LIST OF 8-CHARACTER STRINGS STORED IN
C THE ARRAY NAMES.   IF A MATCH IS FOUND, THE VALUE OF MONITOR IS SET
C EQUAL TO THE SUBSCRIPT OF THE MATCHING NAME IN THE LIST.   A MAXIMUM
C OF NX NAMES WILL BE SEARCHED.   IF NO MATCHING NAME IS FOUND, THE
C VALUE OF MONITOR WILL BE SET TO  X + 1.        IF THE CARD WHICH WAS
C READ IS AN END-OF-FILE CARD, THE VALUE OF MONITOR IS SET TO NX + 2.
C IN THE ARRAY INPUT WILL BE RETURNED TEN WORDS OF HOLLERITH CHARACTERS
C READ FROM COLUMNS 1-80 OF THE CARD.   THE ARRAY INPUT MAY BE USED WITH
C A DECODE STATEMENT.
C
C                                          DAVID L. OBITTS
C                                                  JUNE 1968
C
C ///////////////////////////////////////////
C
      DIMENSION NAMES (1), INPUT (10)
C
C . . . . . . . . . . . . . . .
C                F O R M A T S
C . . . . . . . . . . . . . . .
C
1500  FORMAT (10A8)
C
C-----------------------------------------------------------------------
C
C - - - - - - READ ONE CARD WITH A CONTROL WORD IN COLUMNS 1-8.
      READ (LU, 1500) INPUT
      IF (EOF( LU))100, 105                                              **
C - - - - - - AN END-OF-FILE CARD  AS READ.
  100 MONITOR = NX + 2
      RETURN
  105 NAME = INPUT (1)
      IF (NX .LT. 1) GO TO 120                                           **
      DO 110 I = 1, NX
      IF (NAME .EQ. NAMES (I))115, 110
  110 CONTINUE
  120 CONTINUE                                                           **
C - - - - - - THERE WAS NO MATCHING NAME IN THE LIST OF NAMES.
      MONITOR = NX + 1
      RETURN
C - - - - - - A MATCHING NAME WAS FOUND.
  115 MONITOR = I
      RETURN
      END
```

```
      SUBROUTINE CALWAT (W0, FWZ, MODE)
C
      COMMON W (200, 2), PR (200, 2), T (200, 2), TO (200, 2)
      COMMON DELUC(200,2), DDELU(200,2), DELUOZ(200,2)
      COMMON XXDELU(200), XDELUC(200), XDELOZ(200)
      COMMON SECT (3), AIII (3), W C (3), THETA (3)
      COMMON INFLAG (30), NAMES (30), INPUT (10)
      COMMON TTB (2), XWW (2), XPP (2), XTT (2)
      COMMON IFMT (9)
      DIMENSION FNET (200, 2), VNET (200)
C
      COMMON/PTW/XP(200),XT(200),XW(200),TA(200)
      COMMON /HEAD /ISTA, MDATE, NRATE, WL1, TWL2, IF1, IF2, FNU1, FNU2,
     1 NPAGE, DNU, NPTW, IBRITE
      COMMON /XYZW /WX, WY, WZ, CW (9, 120)
      COMMON /XYZ /DX, DY, DZ, CCD (9, 63)
      COMMON /ALFLTR /AL (229), FLTR (229), DUMMY2
      COMMON /ALCALW/ ALC(229),ALW(229),ALOZ(229),OZMXR(19),OZPRS(19)
      COMMON /TRANS /TWAI, TWAD, NTWA, TT (50), TCOI, TCOD, NTCO, TTC (7
     14),TOZI,TOZD,NTOZ,TTOZ(41)
      COMMON /XWT /X (3), WT (3), XK1 (6), XK2 (6), BBODY (75)
      COMMON /PARAMT /M, NANGLES, NU1, NU2, NU3, MK, LUDD, NCOSW, P, Q,
     1PI,LUD,NOZSW
      COMMON /WATERP /RNOBS, FZW, W2T, VLAMB
      COMMON /DATT /NCA, NCB, NWA, NWB, IPP, TSPRAD, IWINDT, NPAER, PLOW
     1, PHIGH, CKNRG, ALO, ZERO, CC22, PUP, PDO, NKORS, LCON, LEVELS, IR
     2WAIT, NBBRAD, LEVUP, LEVDO, TI, TD, TF, NLINES
      COMMON /VALUE /AII
      DIMENSION NNN(6)
C
      EQUIVALENCE (TWAI, TWII), (TWAD, TWID), (NTWA, NTWI)
C
      DATA(NNN=0,0,0,-1,-1,-1)
C
      NOZA1=970
      NOZB1=1080
      NOZA2=1080
      NOZB2=1130
      CALL SYSTEMC(30,NNN)
      GAMMA = .85
      IF (INFLAG (20) .EQ. 0) GO TO 105
      IF (M .LT. 1) GO TO 730                                          **
      DO 100 I = 1, M
      XW (I) = W0 * (XP (I) / XP (1)) * * VLAMB
  100 CONTINUE
  730 CONTINUE                                                         **
  105 XWW (1) = XW (1)
      XWW (2) = XW (M)
      XPP (1) = XP (1)
      XPP (2) = XP (M)
      XTT (1) = XT (1)
      XTT (2) = XT (M)
      TTB (1) = TA (1)
      TTB (2) = TA (M)
C*********************************************************************
C                       DEFINE U VALUES
C*********************************************************************
```

```
      MM = M - 1
      IF (MM .LT. 1) GO TO 735                                              **
      DO 110 I = 1, MM
      N = I + 1
      ABSPP = ABS (XP (I) - XP (N))
      AVPRS=(XP(I)+XP(N))*.5
      WBAR = .5 * (XW (I) + XW (N))
      IF(AVPRS.LT.OZPRS(1)) GO TO 16
      OZBAR=OZMXR(1)
      GO TO 17
16    IF(AVPRS.GT.OZPRS(19)) GO TO 18
      OZBAR=OZMXR(19)
      GO TO 17
18    DO 15 JO=1,19
      IF(AVPRS.LT.OZPRS(JO)) GO TO 15
      OZBAR=((AVPRS-OZPRS(JO))*(OZMXR(JO)-OZMXR(JO-1)))/(OZPRS(JO-1)-
     *OZPRS(JO))+OZMXR(JO-1)
      GO TO 17
15    CONTINUE
17    XDELOZ(I)=ABSPP*OZBAR*.00102 4
      XDELOZ(I)=ABSPP*OZBAR*.00102 4
      XXDELU (I) = WBAR * ABSPP * .0010204
 110  XDELUC (I) = ABSPP * .248
 735  CONTINUE                                                              **
C*************************************************************************
C                           REVERSE P,T,W, AND U ARRAYS
C*************************************************************************
      NPTM1 = NPTW - 1
      NPTP1 = NPTW + 1
      DDELU (NPTW, 1) = DDELU (1, 2) = 0.
      IF (NPTW .LT. 1) GO TO 740                                            **
      DO 120 I = 1, NPTW
      JJ = NPTP1 - I
      W (I) = W (JJ + 200) = XW (JJ)
      PR (I) = PR (JJ + 200) = XP (JJ)
      T (I) = T (JJ + 200) = TA (JJ)
      TO (I) = TO (JJ + 200) = XT (JJ)
      IF (I .EQ. 1) GO TO 115
      T (JJ + 200) = T (I - 1) = .5 * (T (I - 1) + T (I))
      IF (I .EQ. NPTW) GO TO 120
 115  JJ = NPTW - I
      DELUC (I) = DELUC (JJ + 200) = XDELUC (JJ)
      DDELU (I) = DDELU (JJ + 200) = XXDELU (JJ)
      DELUOZ(I)=DELUOZ(JJ+200)=XDELOZ(JJ)
 120  CONTINUE
 740  CONTINUE                                                              **
 125  IF (INPUT (2) .EQ. 5HSMITH)130, 135
 130  ASSIGN 305 TO NSMITH
      GO TO 140
 135  ASSIGN 310 TO NSMITH
      ASSIGN 355 TO IPTH
      ASSIGN 405 TO IPTD
 140  IF (INFLAG (9) .EQ. 1)145, 150
 145  GO TO 670
 150  IF (INFLAG (5) .EQ. 1)155, 170
 155  LUA = 1
      IF (INFLAG (6) .EQ. 1)160, 165
```

```
 160  LUB = 2
      GO TO 175
 165  LUB = 1
      GO TO 175
 170  LUA = 2
      LUB = 2
 175  IF (LUB .LT. LUA) GO TO 745                                      **
      DO 655 LUD = LUA, LUB
      LUDD = 200 * (LUD - 1)
      MKI = 1
      GO TO (180, 185), LUD
 180  LEVELS = LEVUP
      MKF = NSUBS (PUP, PR (1, 1), NPTW)
      GO TO 190
 185  LEVELS = LEVDO
      MKF = NSUBS (PDO, PR (1, 2), NPTW)
 190  MKF = MKF
      MKL = MKF - 1
      IF (INFLAG (21) .EQ. 1) GO TO 220
      IF ((NPAGE .EQ. 1) .AND. (NLINES .EQ. 0))195, 215
 195  IF (INFLAG (20) .EQ. 0) GO TO 200
      CALL HEADWAT (LUD)
      PRINT 1500, VLAMB
1500  FORMAT (90X,*LAMBDA = *,F6.2)
      NLINES = NLINES + 1
      GO TO 215
 200  GO TO (210, 205), IPP
 205  PRINT 1502, ALO, NDATE
1502  FORMAT (1H1,9X,*ANGLE = *,F5.1,40X,*COMPUTED *,A8)
      NLINES = 1
      GO TO 215
 210  CALL HEADING (LUD)
      NLINES = NLINES + 1
 215  IF (INFLAG (20) .EQ. 0) GO TO 225
 220  MKN = 1
      MKL = MM
      GO TO 285
 225  GO TO (230, 245), IBRITE
 230  ASSIGN 235 TO IBLACK
      TEMP = - 270.
      DO 240 J = 1, 75
      GO TO 685
 235  BBODY (J) = SUM6
 240  TEMP = TEMP + 5.
C***********************************************************************
C                                                   LEVELS LOOP
C***********************************************************************
 245  ML = 1
      MKO = 0
      MKN = MKF - 1
 250  TEMP = TTB (LUD) - 273.16
      ASSIGN 255 TO IBLACK
      GO TO 685
 255  GO TO (260, 265), IBRITE
 260  AII = SUM6
      UCX = 0.
      UUX = 0.
```

```
      ASSIGN 275 TO NWRITE
      GO TO 600
  265 IF (INFLAG (18) .EQ. 0) GO TO 270
      MK = MKO + 1
      FNET (MK, LUD) = SUM6 * PI * 1.E+4 / 699.
  270 IF (INFLAG (13) .EQ. 1) GO TO 280
      PRINT 1518, ZERO, SUM6, ZERO, ZERO
  275 SUM7 = SUM6 * CC22
      PRINT 1520, XPP (LUD), XTT (LUD), XWW (LUD), ZERO, SUM7
  280 IF (MKL .LT. MKI) GO TO 750                                      **
      MK=MKI
  281 MKN = MKF - MK
C***********************************************************************
C                                                  ANGULAR LOOP
C***********************************************************************
  285 K=1
  286 CTT = SECT (K)
      MKI = MKN
      MM = MKL
C***********************************************************************
C                                                  FREQUENCY LOOP
C***********************************************************************
      SUM2 = SUM3 = SUM6 = SUM7 = 0.
      SUMTA = SUMTB = 0.
  290 IF (NU2 .LT. NU1) GO TO 760                                      **
      DO 565 I = NU1, NU2, NU3
      FACT = 1.
      IF ((I .EQ. NU1) .OR. (I .EQ. NU2)) FACT = .5
      UNU = I
      IF (INFLAG (13) .EQ. 0) GO TO 295
      PRINT 1504, UNU
 1504 FORMAT (//*0PRESSURE*,10X,*TEMP*,12X,*DT/D(LN(P))*,10X,*FREQUENCY
     1= *,F6.1)
      PUNCH 1506, ISTA, MDATE, UNU
 1506 FORMAT (13X,2A8,*F↓9REQUENCY↓1 = *,F4.0,*(1/↓9CM↓1)*)
      MKI = MKI
  295 UNU3 = UNU * * 3
      CX = UX = UUX = UCX = 0.
      XUX = XCX = 0.
      PW = TW = PC = TC = 0.
      OZX=XOZX=UOZX=0.
      POZ=TOZ=0.
      SUMTA = 0.
  300 IP1 = 1.
      GO TO NSMITH, (305, 310)
  305 ASSIGN 355 TO IPTH
      ASSIGN 405 TO IPTD
      IF ((UNU .GE. 202.5) .AND. (UNU .LE. 797.5)) ASSIGN 390 TO IPTH
      IF ((UNU .GE. 507.5) .AND. (UNU .LE. 817.5)) ASSIGN 440 TO IPTD
  310 TTBLUD = TO (MM + 1, LUD) + 273.16
      SUMS = SUM = 0.
C***********************************************************************
C                                                  HEIGHT LOOP
C***********************************************************************
      IF (MM .LT. MKI) GO TO 765                                       **
      DO 555 J = MKI, MM
      JCLUD = J + LUDD
```

```
      XUX = XUX + UDELU (J, LUD)
      XCX = XCX + UELUC (J, LUD)
      XOZX=XOZX+DELUOZ(J,LUD)
C*****************************************************************************
C                         CALCULATE EFFECTIVE PRESSURE AND TEMPERATURE
C*****************************************************************************
      DUCX = UELUC (J, LUD) * CTT
      DUUX = UDELU (J, LUD) * CTT
      DUOZX=DELUOZ(J,LUD)*CTT
      PB = .5 * (PR (J, LUD) + PR (J + 1, LUD))
  315 UUX = UUX + DUUX
      PW = PW + PB * DUUX
      TW = TW + T (J, LUD) * DUUX
  320 PEW = PW / UUX
  325 TEW = TW / UUX
  330 UCX = UCX + DUCX
      PC = PC + PB * DUCX
      TC = TC + T (J, LUD) * DUCX
  335 PEC = PC / UCX
  340 TEC = TC / UCX
      UOZX=UOZX+DUOZX
      POZ=POZ+PB*DUOZX
      TOZ=TOZ+T(J,LUD)*DUOZX
      PEOZ=POZ/UOZX
      TEOZ=TOZ/UOZX
      PRAT = PB * .001
      UX = UX + DUUX * (PRAT) * * GAMMA
      CX = CX + DUCX * (PRAT) * * .6
      OZX=OZX+DUOZX*(PRAT)**.85
  345 IF (UX)385, 385, 350
  350 GO TO IPTH, (355, 390)
  355 TRAT = 293.19 / T (J, LUD)
      IF(TRAT.LE.0.) GO TO 356
      A1 = ALOG10 (TRAT)
  356 A2=TRAT-1.
C*****************************************************************************
C                                      LOG(L) FOR WATER VAPOR
C*****************************************************************************
      IF (UX .LE. 0.) GO TO 385
      IF (I .GT. 950) GO TO 360
      UDIF = UNU
      ACOEF = .98E-5
      GO TO 375
  360 UDIF = UNU - 1595.
      IF (UDIF)365, 370, 370
  365 ACOEF = 2.4E-5
      GO TO 375
  370 ACOEF = 1.75E-5
  375 WW = T * .1
      IW = WW
      ALIII = AL (IW + 1) + (WW - IW) * (AL (IW + 2) - AL (IW + 1))
      AALOG = ALIII + A1 - ACOEF * A2 * UDIF * * 2
C*****************************************************************************
C                                      TAU FOR WATER VAPOR
C*****************************************************************************
      ULOGWA = ALOG10 (UX)
      ALU = ULOGWA + AALOG
```

```
      WW = (ALU - TWAI) / TWAD
      IW = WW
      IF (IW .LT. 0) GO TO 385
      IF (IW .GT. NTWA) GO TO 380
      T2 = TT (IW + 1) + (WW - IW) * (TT (IW + 2) - TT (IW + 1))
      IF (T2 .GT. 1.) T2 = 1.
      IF (T2 .GT. 1.E-10) GO TO 395
 380  TP2 = 0.
      GO TO 480
 385  T2 = 1.
      GO TO 395
C-------------------------- SET UP WITH SMITH TABLES ----------------
 390  IF (UUX .LE. 0.) GO TO 385
      WX = ALOG (UUX)
      WY = ALOG (PEW * .001)
      WZ = ALOG (TEW / 273.16)
      T2 = TAUW (UNU)
C--------------------------------------------------------------------
 395  TP2 = T2
      GO TO (400, 430), NCOSW
 400  GO TO IPTD, (405, 440)
 405  IF (CX .LE. 0.) GO TO 435
      IF (I .LT. NCA) GO TO 435
      IF (I .GT. NCB) GO TO 435
C********************************************************************
C                             LOG(L) FOR CARBON DIOXIDE
C********************************************************************
      UDIF = UNU - 667.
      IF (UDIF)410, 415, 415
 410  ACOEF = 4.6E-4
      GO TO 420
 415  ACOEF = 3.4E-4
 420  WW = T * .1
      IW = WW
      ALCIII = ALC (IW + 1) + (WW - IW) * (ALC (IW + 2) - ALC (IW + 1))
      ACLOG = ALCIII + A1 - ACOEF * A2 * UDIF * * 2
C********************************************************************
C                             TAU FOR CARBON DIOXIDE
C********************************************************************
      ULOGCO = ALOG10 (CX)
      ACLU = ULOGCO + ACLOG
      WW = (ACLU - TCOI) / TCOD
      IW = WW
      IF (IW .LT. 0) GO TO 435
      IF (IW .GT. NTCO) GO TO 425
      T2C = TTC (IW + 1) + (WW - IW) * (TTC (IW + 2) - TTC (IW + 1))
      IF (T2C .GT. 1.) T2C = 1.
      IF (T2C .GT. 1.E-10) GO TO 445
 425  TP2 = 0.
      GO TO 480
 430  UCX = 0.
 435  T2C = 1.
      GO TO 445
C-------------------------- SET UP WITH SMITH TABLES ----------------
 440  IF (UCX .LE. 0.) GO TO 435
      DX = ALOG (UCX)
      DY = ALOG (PEC * .001)
```

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```
      DZ = ALOG (TEC / 273.16)
      T2C = TAUCD (UNU)
C-----------------------------------------------------------------------
 445  TP2 = TP2 * T2C
      GO TO (1,2),NOZSW
    1 IF(UOZX.LE.0.) GO TO 3
      IF(I.LT.NOZA1) GO TO 3
      IF(I.GT.NOZB2) GO TO 3
      IF(I.LT.NOZB1) GO TO 4
      IF(I.GE.NOZA2) GO TO 5
      GO TO 3
C***********************************************************************
C                                  LOG(L) FOR OZONE
C***********************************************************************
    4 UDIF=UNU-1043.
      IF(UDIF) 6,7,7
    5 UDIF=UNU-1110.
      IF(UDIF) 8,9,9
    8 ACOEF=14.E-4
      GO TO 10
    9 ACOEF=40.E-4
      GO TO 10
    6 ACOEF=4.E-4
      GO TO 10
    7 ACOEF=14.0E-4
   10 WW=I*.1
      IW=WW
      ALOZII=ALOZ(IW+1)+(WW-IW)*(ALOZ(IW+2)-ALOZ(IW+1))
      AOZLOG=ALOZII+A1-ACOEF*A2*UDIF**2
C***********************************************************************
C                                  TAU FOR OZONE
C***********************************************************************
      ULOGOZ=ALOG10(OZX)
      AOZLU=ULOGOZ+AOZLOG
      WW=(AOZLU-TOZI)/TOZD
      IW=WW
      IF(IW.LT.0) GO TO 3
      IF(IW.GT.NTOZ) GO TO 11
      T2OZ=TTOZ(IW+1)+(WW-IW)*(TTOZ(IW+2)-TTOZ(IW+1))
      IF(T2OZ.GT.1.) T2OZ=1.
      IF(T2OZ.GT.1.E-10) GO TO 12
   11 TP2=0.
      GO TO 480
    2 UOZX=0.
    3 T2OZ=1.
   12 TP2=TP2*T2OZ
      GO TO (465, 450), IWINDT
C------------------------------- BIGNELL  WINDOW -----------------------
 450  IF (I - 700)475, 455, 455
 455  IF (I - 1200)460, 475, 475
 460  WW = .01 * (I - 700)
      IW = WW
      WD = WW - IW
      VALK1 = XK1 (IW + 1) + WD * (XK1 (IW + 2) - XK1 (IW + 1))
      VALK2 = XK2 (IW + 1) + WD * (XK2 (IW + 2) - XK2 (IW + 1))
      PBAR = .5 * (PR (J, LUD) + PR (J + 1, LUD))
      DELP = ABS (PR (J + 1, LUD) - PR (J, LUD))
```

```
      TBAR = T (J, LUD)
      WBAR = .5E-3 * (W (J + 1, LUD) + W (J, LUD))
      TMLN = WBAR * PBAR * DELP * (VALK1 * TTB (LUD) / TBAR + VALK2 * WB
     1AR / .622) / XPP (LUD) / 980.
      SUMTB = SUMTB + TMLN
      T2W = EXP ( - SUMTB)
      GO TO 480
C------------------------------ STANDARD WINDOW --------------------------
  465 IF (I .LT. NWA) GO TO 475
      IF (I .GT. NWB) GO TO 475
C**************************************************************************
C                               LOG(L) FOR WINDOW
C**************************************************************************
      IF (UX .LE. 0.) GO TO 475
      ULOGWA = ALOG10 (UX)
      WW = T * .1
      IW = WW
      ALWIII = ALW (IW + 1) + (WW - IW) * (ALW (IW + 2) - ALW (IW + 1))
      AWLU = ULOGWA + ALWIII
      WW = (AWLU - TWII) / TWID
      IW = WW
      IF (IW .LT. 0) GO TO 475
      IF (IW .GT. NTWI) GO TO 470
C**************************************************************************
C                               TAU FOR WINDOW
C**************************************************************************
      T2W = TT (IW + 1) + (WW - IW) * (TT (IW + 2) - TT (IW + 1))
      IF (T2W .GT. 1.) T2W = 1.
      IF (T2W .GT. 1.E-10) GO TO 480
  470 TP2 = 0
      GO TO 480
  475 T2W = 1.
  480 TP2 = TP2 * T2W
      IF (J - MK1)515, 515, 485
  485 GO TO (490, 515), NPAER
  490 IF (PR (J, LUD) - PLOW)515, 495, 495
  495 IF (PR (J, LUD) - PHIGH)500, 500, 515
C------------------------------ AEROSOL  CALCULATION ---------------------
  500 DELP = ABS (PR (J + 1, LUD) - PR (J, LUD))
      PBAR = .5 * (PR (J + 1, LUD) + PR (J, LUD))
      SUMTA = SUMTA + T (J, LUD) * DELP / PBAR
      TPAER = EXP ( - CKNRG * SUMTA)
      IF (TPAER - .01)505, 505, 510
  505 MM = J - 1
      GO TO 290
  510 TP2 = TP2 * TPAER
  515 DT = TP2 - TP1
      TP1 = TP2
      GO TO (525, 520), IPP
  520 PBAR = .5 * (PR (J, LUD) + PR (J + 1, LUD))
      DTDLNP = PBAR * DT / (PR (J, LUD) - PR (J + 1, LUD))
      PRINT 1508, PBAR, T (J, LUD), DTDLNP
      PUNCH 1510, PBAR, DTDLNP
 1508 FORMAT (1H0,F8.2,F14.2,F23.5)
 1510 FORMAT (F7.1,F9.4)
      GO TO 550
C**************************************************************************
```

```
C                                   PLANCK FUNCTION
C****************************************************************************
  525 PWR1 = W * UNU / T (JCLUD)
      WW = T * .1
      IW = WW
      FLTRIII = FLTR (IW + 1) + (WW - IW) * (FLTR (IW + 2) - FLTR (IW +
     11))
      AI = 0.
      IF (PWR1 .LT. 690.) AI = P * UNU3 / (PI * (EXP (PWR1) - 1.))
  530 IF (J .LT. MM) GO TO 545
      PWR2 = W * UNU / TTBLUD
      IF (PWR2 .GE. 690.) GO TO 535
      AIO = P * UNU3 / (PI * (EXP (PWR2) - 1.))
      GO TO 540
  535 AIO = 0.
  540 SUM3 = SUM3 + AIO * IP2 * FLTRIII * FACT
  545 SUM = SUM + AI * DT * FLTRIII * FACT
  550 CONTINUE
  765 CONTINUE                                                              **
C****************************************************************************
C                                         END OF HEIGHT LOOP
C****************************************************************************
      GO TO (555, 565), IPP
  555 SUM2 = SUM2 + SUM
      GO TO (560, 565), ISPRAD
  560 AII = SUMS - SUM
      AII = AII / FACT
      PRINT 1512, UNU, AII
 1512 FORMAT (2F20.8)
  565 CONTINUE
  760 CONTINUE                                                              **
C****************************************************************************
C                                         END OF FREQUENCY LOOP
C****************************************************************************
      GO TO (570, 640), IPP
  570 AII = (SUM3 - SUM2) * UNU
      IF ((INFLAG (20) .EQ. 0) .AND. (INFLAG (21) .EQ. 0)) GO TO 585
      FWZ = AII - RNOBS
      IF (INFLAG (21) .EQ. 1) GO TO 580
      WP = W0 * 1000.
      GO TO (575, 580), MODE
  575 PRINT 1514, WP, AII, DUX, FWZ
 1514 FORMAT (1H0,F15.2,E24.6,E21.6,E16.4)
  580 RETURN
  585 IF (INFLAG (18) .EQ. 0) GO TO 590
      ML = ML + 1
      FNET (ML, LUD) = AII * PI * 1.E+4 / 699.
  590 AIII (K) = AII * WSC (K)
      GO TO (595, 635), IBRITE
  595 ASSIGN 640 TO NBRITE
  600 DO 605 LOOK = 1, 75
      IF (AII - BBODY (LOOK))615, 610, 605
  605 CONTINUE
      TEQBB = 100.
      GO TO 630
  610 TEQBB = 5. * (LOOK - 1) - 273.
      GO TO 630
```

```
615   IF (LOOK - 1)625, 620, 625
620   TEQBB = - 270.
      GO TO 630
625   TEQBB = 5. * (LOOK - 2) - 27 . + 5. * (AII - BBODY (LOOK - 1)) / (
     1BBODY (LOOK) - BBODY (LOOK - 1))
630   TATM = TO (M, LUD) - TEQBB
      PRINT 1516, THETA (K), AII, XCX, XUX, TEQBB, TATM
1516  FORMAT (58X,F9.2,E15.4,F12.4,E13.3,2F8.1)
      GO TO NBRITE, (640, 275)
635   PRINT 1518, THETA (K), AII, XCX, XUX
      NLINES = NLINES + 1
1518  FORMAT (58X,F9.2,E15.4,F12.4,E13.3)
 640  K=K+1
      IF(K.LE.NANGLES)    GO TO 28
C****************************************************************************
C                                        END OF ANGULAR LOOP
C****************************************************************************
      GO TO (645, 725), IPP
645   MKO = MKN
      SUM7 = AIII (1) + AIII (2) + AIII (3)
      MKOLUD = MKO + LUDD
      PRINT 1520, PR (MKOLUD), TO  MKOLUD), W (MKOLUD), DDELU (MKOLUD),
     1SUM7
1520  FORMAT (F8.1,F11.1,F13.4,E12.3,E15.6/)
      NLINES = NLINES + 1
      IF (NLINES .LT. 30) GO TO 65
      NLINES = 0
      NPAGE = NPAGE + 1
      CALL HEADING (LUD)
 650  MK=MK+LEVELS
      IF(MK.LE.MKL)    GO TO 281
750   CONTINUE                                                             **
      NPAGE = 1
      NLINES = 0
655   CONTINUE
745   CONTINUE                                                             **
      IF (INFLAG (18) .EQ. 0) GO TO 725
      MKK = MKF + 1
      IF (MKF .LT. 1) GO TO 770                                            **
      DO 660 MK = 1, MKF
      MKP = MKK - MK
660   VNET (MK) = FNET (MK, 1) - FNET (MKP, 2)
770   CONTINUE                                                             **
      PRINT 1522
1522  FORMAT (*1PRESSURE    F(NET)  ATM. TEMP. CHANGE*/)
      CONATM = 5880.
      PRINT 1524, PR (1, 2), VNET (1), ZERO
1524  FORMAT (F8.1,F12.4,F10.1)
      PUNCH 1526, PR (1, 2), TO (1, 2), FNET (1, 1), FNET (MKF, 2), VNET
     1 (1), ZERO
      IF (MKF .LT. 2) GO TO 775                                            **
      DO 665 MK = 2, MKF
      ATMCH = (VNET (MK - 1) - VNET (MK)) / (PR (MK - 1, 2) - PR (MK, 2)
     1) * CONATM
      PRINT 1524, PR (MK, 2), VNET (MK), ATMCH
      MKP = MKK - MK
      PUNCH 1526, PR (MK, 2), TO (MK, 2), FNET (MK, 1), FNET (MKP, 2), V
```

```
     1NET (NK), ATMCH
1526  FORMAT (1X,F7.1,8X,F8.1,3F8.4,F8.1)
 665  CONTINUE
 775  CONTINUE                                                    **
      GO TO 725
C*******************************************************************************
C                          BLACK BODY CALIBRATION LOOP
C*******************************************************************************
 670  ASSIGN 680 TO IST
      NLINES = 0
      NPAGE = 1
      TEMP = TI
      ASSIGN 710 TO IBLACK
 675  GO TO IST, (680, 685)
 680  ASSIGN 685 TO IST
      CALL HEADING (3)
      PRINT 1528
1528  FORMAT (*  TEMP.*,6X,*IRRADIANCE*,8X,*RADIANCE*,6X,*RADIANCE*/
     1 15X,*W/SQ CM*,8X,*W/SQ CM SR*,5X,*(NORMAL)*/)
 685  SUM6 = SUM5 = 0.
      IF (NU2 .LT. NU1) GO TO 780                                 **
      DO 705 I = NU1, NU2, NU3
      UNU = I
      PWR3 = Q * UNU / (TEMP + 273.16)
      AI = 0.
      IF (PWR3 .LT. 690.) AI = P * UNU * * 3 / (PI * (EXP (PWR3) - 1.))
      WW = I * .1
      IW = WW
      FLTRIII = FLTR (IW + 1) + (WW - IW) * (FLTR (IW + 2) - FLTR (IW +
     11))
      SUM66 = AI * FLTRIII * UNU
      SUM55 = FLTRIII
 690  IF ((I .EQ. NU1) .OR. (I .EQ. NU2))695, 700
 695  SUM66 = SUM66 * .5
      SUM55 = SUM55 * .5
 700  SUM6 = SUM6 + SUM66
      SUM5 = SUM5 + SUM55
 705  CONTINUE
 780  CONTINUE                                                    **
      GO TO IBLACK, (710, 235, 255)
 710  SUMN = SUM6 / SUM5
      SUM7 = SUM6 * CC22
      PRINT 1530, TEMP, SUM7, SUM6, SUMN
1530  FORMAT (F7.1,E18.6,2F14.7)
      NLINES = NLINES + 1
      IF (NLINES .GE. 50)715, 720
 715  NLINES = 0
      NPAGE = NPAGE + 1
      ASSIGN 680 TO IST
 720  TEMP = TEMP + TD
      IF (TEMP .LE. TF)675, 725
 725  RETURN
      END
```

```
      SUBROUTINE TABPRNT (AL, IHDAL)
      COMMON /TRANS /IWAI, IWAD, NTWA, TT (50), TCOI, TCOD, NTCO, ITC (7
     14), TOZI, TOZD, NTOZ, TTOZ(41)
      DIMENSION AL (229), IHDAL (2)
      DIMENSION IFRQ (5), VAL (5)
      ENTRY VLNPRNT
      PRINT 1500, IHDAL
 1500 FORMAT (1H1,36X,2A8//2X,5(*   FREQ  LN(L)*)/)
      DO 105 II = 1, 29
      KK = II
      DO 100 JJ = 1, 5
      IFRQ (JJ) = (KK - 1) * 10
      VAL (JJ) = AL (KK)
  100 KK = KK + 50
      PRINT 1502, (IFRQ (I), VAL (I), I = 1, 5)
 1502 FORMAT (2X,5(I7,F7.2))
  105 CONTINUE
      DO 115 II = 30, 50
      KK = II
      DO 110 JJ = 1, 4
      IFRQ (JJ) = (KK - 1) * 10
      VAL (JJ) = AL (KK)
  110 KK = KK + 50
      PRINT 1502, (IFRQ (I), VAL (I), I = 1, 4)
  115 CONTINUE
      RETURN
      ENTRY TWATER
      PRINT 1504
 1504 FORMAT (1H1,31X,*WATER VAPOR*//7X,*LN(L)      TAU*,2(8X,*LN(L)
     1TAU*)/)
      DO 120 I = 18, 20
      I3 = I + 20
      VLNA = I * .1 - 3.8
      VLNB = VLNA + 2.
      PRINT 1506, VLNA, TT (I), VLNB, TT (I3)
 1506 FORMAT (21X,2(F11.1,F10.4))
  120 CONTINUE
      DO 125 I = 1, 10
      I2 = I + 20
      I3 = I2 + 20
      VLNA = I * .1 - 3.8
      VLNB = VLNA + 2.
      VLNC = VLNB + 2.
      PRINT 1508, VLNA, TT (I), VLNB, TT (I2), VLNC, TT (I3)
 1508 FORMAT (3(F11.1,F10.4))
  125 CONTINUE
      DO 130 I = 11, 17
      I2 = I + 20
      VLNA = I * .1 - 3.8
      VLNB = VLNA + 2.
      PRINT 1508, VLNA, TT (I), VLNB, TT (I2)
  130 CONTINUE
      RETURN
      ENTRY TCARBON
      PRINT 1510
 1510 FORMAT (1H1,29X,*CARBON DIOXIDE*//
     1  7X,*LN(L)*,5X,*TAU*,2(8X,*LN(L)     TAU*)/)
```

```
      DO 135 I = 1, 2
      VLNA = I * .1 - 5.3
      PRINT 1508, VLNA, TTC (I)
135   CONTINUE
      DO 140 I = 3, 14
      I2 = I + 30
      I3 = I2 + 30
      VLNA = I * .1 - 5.3
      VLNB = VLNA + 3.
      VLNC = VLNB + 3.
      PRINT 1508, VLNA, TTC (I), VLNB, TTC (I2), VLNC, TTC (I3)
140   CONTINUE
      DO 145 I = 15, 32
      I2 = I + 30
      VLNA = I * .1 - 5.3
      VLNB = VLNA + 3.
      PRINT 1508, VLNA, TTC (I), VLNB, TTC (I2)
145   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE HEADWAT (LUD)
C*******************************************************************
C                                 PRINT HEADING AND INPUT PARAMETERS
C*******************************************************************
C
      COMMON /HEAD /ISTA, MDATE, NDATE, WL1, IWL2, IF1, IF2, FNU1, FNU2,
     1 NPAGE, DNU, NPIW, IBRITE
C
      DIMENSION NHEAD (3)
C
C
      DATA (NHEAD = 8H  UPWARD, 8HDOWNWARD, 8HBB CALIB)
      PRINT 1500, ISTA, MDATE, NDATE, NPAGE
 1500 FORMAT (1H1,*STATION, *,A8,5X,*DATE, *,A8,66X,*CALCULATED, *,A8,
     1 5X,*PAGE *,I3)
      PRINT 1502, WL1, IWL2, IF1, IF2
 1502 FORMAT (*0WAVE LENGTH REGION FROM *,F8.2,* TO *,A8,
     1 * MICRONS WITH FILTER = *,2 8)
      LL = LUD
      PRINT 1504, FNU1, FNU2, DNU, NHEAD (LL), NPTW
 1504 FORMAT (7X,*WAVE NUMBERS FROM *,F8.2,* TO *,F8.2,* BY *,F8.2,28X,
     1 A8,* RADIANT POWER FOR *,I3,* LAYERS*)
      PRINT 1506
 1506 FORMAT (1H0,11X,*W 0*,15X,*RADIANCE*,11X,*WATER VAPOR*,9X,
     1  *DIFFERENCE*/12X,3HPPM,14X,*W/SQ CM SR*,30X,*W/SQ CM SR*/)
      RETURN
      END
```

```
      SUBROUTINE HEADING (LUD)
C**********************************************************************
C                              PRINT HEADING AND INPUT PARAMETERS
C**********************************************************************
C
      COMMON /HEAD /ISTA, MDATE, NDATE, WL1, IWL2, IF1, IF2, FNU1, FNU2,
     1 NPAGE, DNU, NPTW, IBRITE
C
      DIMENSION NHEAD (3)
C
C
      DATA (NHEAD = 8H  UPWARD, 8HDOWNWARD, 8HBB CALIB)
      PRINT 1500, ISTA, MDATE, NDATE, NPAGE
 1500 FORMAT (1H1,*STATION, *,A8,5X,*DATE, *,A8,66X,*CALCULATED, *,A8,
     1 5X,*PAGE *,I3)
      PRINT 1502, WL1, IWL2, IF1, IF2
 1502 FORMAT (*0WAVE LENGTH REGION FROM *,F8.2,* TO *,A8,
     1 * MICRONS WITH FILTER = *,2A8)
      LL = LUD
      PRINT 1504, FNU1, FNU2, DNU, NHEAD (LL), NPTW
 1504 FORMAT (7X,*WAVE NUMBERS FROM *,F8.2,* TO *,F8.2,* BY *,F8.2,28X,
     1 A8,* RADIANT POWER FOR *,I3,* LAYERS*)
      GO TO (100, 105), IBRITE
  100 PRINT 1506
 1506 FORMAT (*0PRESSURE*,5X,*TEMP.*,5X,*MIX RATIO*,5X,*DELU*,5X,*IRRADI
     1ANCE*,5X,*ANGLE*,5X,*RADIANCE*,8X,*CO 2*,8X,*H2O*,7X,*BRIGHT   ATM
     2*/49X,*W/SQ CM*,15X,*W/SQ CM SR*,1X,2(4X,*GM/SQ CM*),5X,*TEMP*,4X,
     3 *CORR*)
      RETURN
  105 PRINT 1508
 1508 FORMAT (*0PRESSURE*,5X,*TEMP.*,5X,*MIX RATIO*,5X,*DELU*,5X,*IRRADI
     1ANCE*,5X,*ANGLE*,5X,*RADIANCE*,8X,*CO 2*,8X,*H2O*
     2 /49X,*W/SQ CM*,15X,*W/SQ CM SR*,1X,2(4X,*GM/SQ CM*))
      RETURN
      END
```

```
      FUNCTION NSUBS (P, VP, NP)
C*****************************************************************************
C
C                   SEARCHES PRESSURE ARRAY TO DETERMINE SUBSCRIPT FOR
C                   SPECIFIED PRESSURE
C        P IS THE SPECIFIED PRESSURE
C        VP IS THE ARRAY OF PRESSURE VALUES
C        NP IS THE NUMBER OF PRESSURE VALUES
C        NSUBS IS THE DESIRED SUBSCRIPT
C
C*****************************************************************************
      DIMENSION VP (10)
      IF (NP .LT. 1) GO TO 110                                                **
      DO 100 I = 1, NP
      IF (ABS (P - VP (I)) .LT. .01) GO TO 105
  100 CONTINUE
  110 CONTINUE                                                                **
      NSUBS = 1
      RETURN
  105 NSUBS = I
      RETURN
      END
```

```
      FUNCTION TAUW (VNU)
C  WATER TRANSMITTANCE FOR NU = (2 2.5,797.5) BY 5.
      COMMON /XYZW /X, Y, Z, C (9, 120)
      W (I) = C (1, I) + Z * (C (4, I) + C (9, I) * Y * Z) + X * (C (2,
     1I) + Z * (C (6, I) + C (8, I) * X) + C (7, I) * X) + Y * (C (3, I)
     2 + C (5, I) * X)
      WS = (VNU - 202.5) * .2
      IL = WS
      WL = W (IL + 1)
      WA = WL + (WS - IL) * (W (IL + 2) - WL)
      TAUW = EXP ( - EXP (WA))
      RETURN
      END
```

```
      FUNCTION TAUCD (VNU)
C   CARBON DIOXIDE TRANSMITTANCE FOR NU = (507.5,817.5) BY 5.
      COMMON /XYZ /X, Y, Z, CCD (9, 63)
      W (I) = CCD (1, I) + Z * (CCD (4, I) + X * (CCD (6, I) + CCD (9, I
     1) * Z)) + CCD (3, I) * Y + X * (CCD (2, I) + CCD (5, I) * Y + X *
     2(CCD (7, I) + CCD (8, I) * Y))
      WS = (VNU - 507.5) * .2
      IL = WS
      WL = W (IL + 1)
      WA = WL + (WS - IL) * (W (IL + 2) - WL)
      TAUCD = EXP ( - EXP (WA))
      RETURN
      END
```

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```
SUBROUTINE DUMMY1
COMMON /XYZW /WX, WY, WZ, CW (9, 120)
DATA (CW = 6.1218, .9142, .9 11, - .4374, .04956, 0., .01814, 2 (0
1.), 6.175, 1.0287, .9704, 0., .05409, .0989, .0244, 2 (0.), 5.6094
2, .9578, .916, 0., .05039, - .0841, .02266, 2 (0.), 4.8955, .988,
3.9591, 0., .04072, 0., .01177, 2 (0.), 5.3723, .8413, .8257, - 1.2
4625, .03251, - .2771, .01391, - .01445, 0., 4.8715, .6848, .662, 0
5., .05101, .0097, .00952, - .00131, .1005, 3.8296, .6492, .6619, 0
6., .07255, - .2476, .00096, 0., .69852, 4.0639, .9648, .9847, 0.,
7.01800, 2 (0.), .02738, 0., .8635, .8249, .7741, 0., .03037, 0.,
8.01542, .01957, .50334, 5.4729, .797, .7156, 2.1261, .02349, .4997
9, .01409, .03768, 0., 5.5674, 1.0058, .9283, 0., .06286, - .0611,
A.03037, 2 (0.), 3.5271, .590 , .6273, 0., - .01128, - .1407, - .01
B135, 2 (0.), 4.2338, 1.0235, 1.0361, .5353)
 DATA((CW(I),I=113,222)
X                    = .05418, - . 352, .00890, 2 (0.), 3.0032, .6309, .
16164, .4302, .02130, - .1506, .00892, 2 (0.), 3.9064, .8782, .896,
2 .3700, .02857, - .2016, 2 ( .), 1.17741, 4.0603, .4581, .5423, 0.
3, - .0043, - .2114, - .01271, - .01834, 0., 3.966, .6008, .5025, 1
4.3724, .01139, .0731, .00522, 2 (0.), 4.5389, .9895, .8969, .9405,
5 .06606, 0., .03052, 2 (0.), 3.4817, .8052, .7685, 1.0741, .02127,
6 0., .01061, 2 (0.), 3.7495, .8629, .8675, 1.1067, .04929, - .1472
7, .01050, 2 (0.), 4.4469, .7224, .6912, 1.3678, .03165, 0., .01193
8, 2 (0.), 3.8072, .8714, .9022, 1.493, .0357, 4 (0.), 3.4957, .970
97, .804, 1.6149, .07145, 0., .02854, - .01295, 0., 3.5555, 1.059,
A.9694, 1.3177, .07048, .0567, .03522, 2 (0.), 3.4924, .7124, .6683
B, 1.0064, .03905, 0.)
 DATA((CW(I),I=223,334)
X                    = .01392, 2 ( .), 4.1125, .7887, .7497, 1.8633, .03
1729, .0722, .01516, 2 (0.), 4.6888, .9455, .8726, 1.4606, .05094,
20., .0222, - .02487, 0., 3.5 36, .9852, .8872, 1.0675, .07393, 0.,
3 .03348, - .01585, 0., 3.1583, .7363, .7083, 1.6959, .03384, .0346
4, .01185, 2 (0.), 3.2042, .8007, .7648, 1.5694, .05751, 0., .0198,
5 2 (0.), 4.7227, .859, .7921, 2.5143, .04153, 0., .01961, - .01034
6, 0., 3.113, .5768, .5826, 1 6107, 0., .0556, - .00328, 0., 0., 2.
75079, .9242, .9058, 1.6898, .05049, 2 (0.), .02292, 0., 2.2004, .8
8052, 7417, 1.3649, .05537, 0., .01964, 2 (0.), 2.9026, .7342, .67
951, 1 7771, .03578, 0., .01517, 2 (0.), 2.3168, .5871, .5786, 1.71
A72, .02019, - .1343, .006, 2 (0.), 2.2132, .7155, .6467, 1.584, .0
B4174, 0., .01497, 2 (0.), 1.0742)
 DATA((CW(I),I=335,441)
X                    = .733, .6939, 1.126, .03095, .2008, .01552, .00321
1, - .6347, 2.1226, .7255, .6 79, 2.1168, .03257, - .1092, .01478,
22 (0.), 3.5291, .6982, .6678, 2.4057, .02918, .0462, .00977, 2 (0.
3), 1.0393, .786, .7293, 2.263, .05824, .145, .02125, .04745, 0., 1
4.4888, .9428, .9105, 2.0498, .06549, - .1445, .00218, 2 (0.), 1.59
567, .075, .9429, 1.4218, .06 12, - .1439, .00204, 2 (0.), 2.1667,
6.4856, .4527, 1.1492, .01137, - .0894, .00441, 2 (0.), 2.5673, .69
786, .6758, 2.7325, .01806, .1562, .00325, .03342, 0., 1.6873, .729
83, .6067, 1.2854, .05759, 0., .00607, .04438, 0., 1.6176, .7252, .
96952, 1.361, .05026, 0., .00 11, 2 (0.), 1.6237, .7975, .7471, 2.4
A456, .04392, - .3088, .01379, 2 (0.), 1.9632, .6293, .6136, 1.2863
B, .03189, 0., .00558, 2 (0.))
 DATA((CW(I),I=442,540)
X                    = 1.4718, .7544, .701, 2.8388, .06191, - .299, .005
144, .0279, .5211, 1.7591, .7715, .7163, 2.7152, .05552, - .1637, .
200638, .01725, .30805, 2.2750, .679, .6232, 1.6932, .03735, .0797,
3 .01304, 2 (0.), 1.3413, .8111, .7501, 2.3745, .05334, - .321, .00
4833, .0213, .68252, 1.4035, 7618, .6937, 2.461, .06784, - .3545,
5.00104, .03859, .26821, 1.9306, .65, .6059, 1.4577, .03822, .0231,
6 .01154, 2 (0.), .9939, .8646, .8111, 1.8684, .05137, - .3699, .01
7051, .05305, 1.60593, 1.4496, .6708, .6215, 1.1994, .03321, .0669,
8 .00601, 2 (0.), 1.0059, .831, .751, 1.9138, .06045, - .3055, .004
909, .05065, 1.47211, 1.1967, .683, .669, 2.2477, .05734, - .1047,
A.00257, .0209, 0., .4625, 1.0025, .927, 1.9155, .05779, - .0633, 3
B (0.))
 END
```

```
      SUBROUTINE DUMMY2
      COMMON /XYZW /WX, WY, WZ, CW (9, 120)
      DATA((CW(I),I=541,660)
     X              = 1.7019, .7317, .6852, 3.4872, .04482, 0., .01091,
     1 0., .03921, 1.35, .711, .6873, 2.0314, .04018, 0., .01015, 2 (0.)
     2, 1.0144, .7584, .6897, 3.6419, .07208, - .4356, - .01145, .03452,
     3 .435, 1.9939, .6404, .6237, 3.413, .03757, 3 (0.), - .09615, .965
     49, .8032, .817, 3.4202, .05245, 0., - .01085, 0., 0., .9526, .6237
     5, .5703, 2.4008, .02423, 0., .00692, 2 (0.), .1357, .8832, .7762,
     62.7012, .0439, - .5505, - .00961, 0., 1.7478, .6216, .7386, .6645,
     7 2.0552, .06975, 4 (0.), .5929, .8461, .7347, 1.7532, .06477, 4 (0
     8.), 1.4393, .6638, .6326, 2.2433, .05921, 4 (0.), .6297, .7306, .6
     9532, 2.1938, .06557, 2 (0.), .04194, 0., .0977, .8421, .729, 2.314
     A5, .06239, - .3976, - .01518, 0., 1.32521, .325, .7953, .6907, 1.3
     B819, .07604, 4 (0.), 1.0674, .6348, .6022)
      DATA((CW(I),I=661,772)
     X              = 1.3958, .04387, 2 (0.), .02679, 0., .4668, .865,
     1.7523, 3.2109, .05747, - .5778, 2 (0.), 2.045, .7381, .7151, .6861
     2, 2.9658, .04528, 0., .01002, 2 (0.), .8434, .642, .5703, 2.7075,
     3.05806, 2 (0.), .06374, 0., .003, .9233, .8748, 3.4166, 0., - .183
     49, - .00702, 2 (0.), 1.1164, .6576, .6401, 2.4402, .06297, .1755,
     5.00247, .05418, - .45706, .2369, .7363, .7574, 2.8881, 0., - .237,
     6 - .01633, 2 (0.), .1762, .6631, .6424, 2.8055, .06562, - .172, 0.
     7, .05076, 0., - .6216, .9947, .8931, 2.0704, .03317, - .144, 3 (0.
     8), - .0405, .8616, .7101, 1.4924, .08775, 4 (0.), .3722, .6929, .6
     9368, 1.8036, .06067, 2 (0.), .02005, 0., .1257, .7646, .7079, 2.93
     A73, .05921, - .5088, - .01064, .02441, 2.01896, .0336, .6296, .586
     B7, 2.0144, .05046, 2 (0.))
      DATA((CW(I),I=773,880)
     X              = .05117, .2812, .0114, .7898, .7005, 3.084, .0826
     19, - .3355, 2 (0.), .20618, .6751, .6999, .6284, 2.558, .06208, 2
     2(0.), .06243, - .09255, .1650, .7703, .6617, 3.1227, .08209, 2 (0.
     3), .06605, 0., - .6688, .872 , .7498, 1.3178, .06925, 0., - .0153,
     4 0., 0., - .0415, .8613, .7676, 1.5691, .10389, - .5763, 0., 0., 1
     5.21192, - .1863, .5866, .587 , .9089, .07812, - .2625, - .01946, .
     602767, .32135, - .3255, .8684, .7576, 1.3227, .07789, 0., 0., .037
     708, 0., - .177, .7475, .6674, .9509, .07456, 4 (0.), - .2946, .793
     83, .6489, 2.0613, .093, - .4435, - .01658, 0., .2332, - .6008, .80
     969, .7206, 1.2687, .09204, - .2858, - .0106, 0., 0., - 1.2156, 1.0
     A442, .9708, .2732, .02229, - .0567, .01363, 0., 0., .0344, .7086,
     B.6034, 1.8627, .05647, 0., 0.)
      DATA((CW(I),I=881,987)
     X              = .08283, .94146, - .1431, .6964, .6444, 2.1392, .0
     1816, - .4796, - .01772, 0., .65367, .0852, .6968, .6318, 2.3108, .
     208782, - .2794, - .01659, .03327, 0., - .585, .8702, .7589, 2.3439
     3, .08026, - .5944, 0., 0., 1.88005, - .001, .6293, .5967, 1.3822,
     4.07426, - .2653, - .01974, .01468, 0., - .5983, .729, .602, 1.8982
     5, .07491, - .6156, - .02065, 0., 1.913, - 1.2443, .986, .8534, .67
     612, .03676, - .1938, 3 (0.), - 1.2809, .98, .8618, 1.0699, .06606,
     7 - .352, 3 (0.), - .9128, .7659, .6462, .7983, .06223, - .5689, - .
     801932, - .03856, 1.52976, - .8131, .7871, .6877, 1.1119, .09877, -
     9 .4304, - .0149, - .053, 0., - 1.4145, 1.0079, 1.0109, 6 (0.), - .
     A2006, .7076, .6073, 3.2032, .08244, - .5402, - .01924, 0., 0., - .
     B8597, .8564, .7451, 1.1123, .104, - .2107)
      DATA((CW(I),I=988,1080)
     X              = - .00685, 0., 0., - .6852, .7274, .6021, 2.042, .
     107252, - .8034, - .02399, - .06718, 1.36298, - 1.246, .9611, .8279
     2, 1.7005, .0522, - .6282, - .0012, - .07092, .98989, - 1.5561, 1.0
     3101, .8169, 0., .06095, - .0026, 0., 0., 1.40942, - 1.217, .9208,
     4.7144, .6104, .09037, - .1294, - .00574, 0., 0., - 1.3441, .922, .
     57982, 1.1841, .07038, - .6780, - .00429, - .0595, 1.03903, - .68,
     6.7769, .5818, 2.2546, .07059, - .4801, - .02203, 0., 2.42264, - 1.
     70037, .7783, .6493, .9905, .9013, - .5305, - .01597, - .02272, 1.
     821459, - 1.5633, 1.0068, .9846, 6 (0.), - 1.2125, .878, .7274, 1.7
     9113, .06813, - .7937, - .00675, - .05651, 1.88107, - .2592, .6565,
     A .5664, 2.2743, .06738, - .3331, - .02609, 0., 0.)
      END
```

```
 SUBROUTINE DUMMY3
 COMMON /XYZ /DX, DY, DZ, CCD (9, 63)
 DATA (CCD = - 12.5563, 1.2516, 0., 0., - .17329, 0., 0., .039227,
1.0465, - 9.0048, 3 (0.), - .13531, .4108, .12205, .03486, 0., - 9.
21021, 0., 0., 3.0247, - .1356, 0., .13428, .036523, 0., - 7.5255,
3 - .5654, - .2076, 3.1339, 0., 0., .18291, .018728, 0., - 7.8368,
44 (0.), .7787, .11912, .012167, 0., - 11.4741, 1.3374, - .1906, 3.
55957, 3 (0.), .019534, 0., - 7.9647, 0., 0., 3.5359, 0., 0., .1240
69, .013978, 0., - 8.719, .7699, 0., .4472, - .0469, 2.79, .04769,
7.019071, .33903, - 9.1824, 1.1398, 0., 1.7502, 0., 2.3209, 0., .01
80606, - .2891, - 10.2269, 1.2544, 0., 4.856, 3 (0.), .014981, 0.,
9- 8.1679, .5104, 3 (0.), 2.1 21, .07902, .014411, - .20992, - 8.21
A75, .7508, 0., 8.0119, 0., - .3037, .05557, .01392, 0., - 8.0988,
B1.1256, - .0707, 7.8956, .04 21, 0.)
  DATA ((CCD(I),I=115,205)
X                  = 0., .006407, - .05619, - 6.9298, .8914, 0., 6.68
112, 0., .4478, .02279, .012015, - .1162, - 6.2296, .9875, 0., 6.98
221, .03299, 0., 0., .006158, - .06665, - 5.65, 1.0686, .0281, 6.23
319, .03985, 0., - .01791, .005244, - .06194, - 4.8285, .9965, .096
49, 5.1455, .06422, - .0355, .0215, 0., - .05157, - 4.011, .9665,
5 .1516, 4.2196, .06243, - .0 79, - .02806, - .001882, - .03566, -
63.4125, .952, .1649, 4.3297, .05547, - .3231, - .02286, - .001121,
7 .02243, - 3.2484, .898, .24 3, 3.0533, .07241, - .2081, - .02458,
8 - .004735, .02096, - 3.2611, .8686, .2645, 2.5396, .064, - .1455,
9 - .01883, - .0036, .01449, - 3.3509, .9495, .215, 2.7713, .0747,
A- .1834, - .02394, - .003601, .01682, - 1.5126, .8122, .2711, 2.72
B53, .1616, - .3039, - .04478)
  DATA ((CCD(I),I=206,295)
X                  = - .007887, .0155, - 1.953, .8463, .2533, 2.8342,
1 .06601, - .287, - .03243, - .005338, .01959, - 2.1364, .9037, .26
248, 2.5698, .08027, - .2002, - .03121, - .006357, .01305, - 1.5385
3, .8421, .3189, 2.1161, .07001, - .1432, - .02476, - .005504, .010
459, - 1.0136, .7563, .3827, .4426, .04069, - .0675, - .01575, - .
5003480, .0054, - .5586, .6964, .4134, 1.0127, .03247, 0., - .01025
6, - .001676, - .00434, - .0106, .7252, .4053, .6414, .03872, .0339
7, - .01753, - .00305, - .00761, .0036, .6937, .4501, .0877, .0359,
8 .018, - .00761, - .001986, - .00745, - .114, .6918, .4622, - .206
96, .03604, 0., 0., - .00095, 0., .2529, .6475, .4216, - .3619, .02
A348, .0506, - .00542, 0., - .00645, 1.3638, .5246, .434, .0297, .0
B0662, - .0893, - .00503, - .000057)
  END
```

```
      SUBROUTINE DUMMY4
      COMMON /XYZ /DX, DY, DZ, CCD (9, 63)
      DATA((CCD(I),I=297,387)
     X                   = .00695, .37, .5234, .397, .1252, .02322, - .0779
     1, .01301, .001827, 0., .0693, .6726, .4055, - .1532, .03386, .0044
     2, .00678, - .001429, - .00230, .016, .6533, .4873, .0948, .02865,
     3.0179, .00028, - .001026, - .00338, - .2339, .6633, .4764, .5516,
     4.02984, .0232, .00071, - .000737, - .0052, - .5269, .6672, .4586,
     51.0241, .03113, 0., - .00153, - .001029, 0., - .8326, .6943, .4371
     6, 1.5264, .03741, - .0096, - .00634, - .002023, - .00233, - 1.4106
     7, .752, .3814, 2.2672, .0494 , - .0849, - .01173, - .003104, .0030
     81, - 1.9623, .8219, .327, 2.8036, .06731, - .2118, - .01992, - .00
     94881, .01569, - 2.546, .879, .2863, 2.918, .07776, - .2568, - .021
     A24, - .005446, .02821, - 1.6 5, .8043, .2803, 2.9613, .06098, - .2
     B636, - .03415, - .005813, .01779)
      DATA((CCD(I),I=388,479)
     X                   = - 1.427, .7581, .3052, 2.4273, .05335, - .3081,
     1- .04472, - .008055, .0217, - 3.3026, .8857, .2736, 2.4157, .07142
     2, - .1082, - .01824, - .0033 5, .01325, - 2.9767, .8424, .2988, 2.
     34131, .06911, - .1974, - .01077, - .004364, .02716, - 3.0163, .874
     41, .2597, 3.1387, .06681, - .121, - .02305, - .004251, .01214, - 3
     5.1692, .9078, .2253, 3.9284, .06231, - .171, - .02981, - .003541,
     60., - 4.099, .9514, .1827, 4.3132, .08807, - .2173, - .02716, - .0
     704737, 0., - 4.6736, .9831, .118, 5.3603, .06576, - .019, - .02236
     8, 0., - .04328, - 5.7219, .998, .0484, 7.249, .03511, 0., - .00874
     9, .006046, - .0089, - 6.6114, .9978, 0., 8.0478, .0433, 0., 0., .0
     A05637, - .07565, - 7.4221, 1.0581, 0., 0.1331, .04566, 0., 0., .00
     B4869, - .08853, - 7.8763, .8391)
      DATA((CCD(I),I=480,567)
     X                   = - .0351, 6 5719, .01215, .6383, .04162, .012539,
     1 - .11983, - 8.3537, .8692, - .0411, 7.3879, 0., 0., .03817, .0149
     224, - .05194, - 9.0114, .983, - .0811, 2.0357, .01224, 1.81, .0277
     35, .014138, - .22558, - 7.4416, .9695, 0., 4.9493, .02164, 1.0906,
     4 0., .005778, - .18784, - 7.1057, .9791, 0., 6.0877, 0., .6197, 0.
     5, .006747, - .14249, - 7.1605, .5334, .2257, 10.4273, 0., 6.8167,
     6.01921, 0., - .14102, - 8.845, 1.0065, - .4464, 8.2588, .16741, -
     7.8311, .00973, - .000534, 0., - 7.7652, .5169, 3 (0.), 2.51, .0595
     86, .011644, - .28153, - 8.3136, .6049, 0., - .8062, - .03048, 3.09
     995, .05332, .016666, - .3415, - 9.4568, 1.0304, 0., 6.3498, 3 (0.)
     A, .016164, 0.)
      END


      SUBROUTINE DUMMY5
      COMMON /ALFLTR /AL (229), FLTR (229)
      DATA (AL = 1.10, 1.40, 1.62, 1.90, 2.04, 2.20, 2.30, 2.40, 2.47, 2
     1.55, 2.60, 2.65, 2.67, 2.68, 2.68, 2.69, 2.69, 2.67, 2.65, 2.63, 2
     2.61, 2.57, 2.53, 2.48, 2.45, 2.40, 2.35, 2.30, 2.23, 2.15, 2.10, 2
     3.03, 1.96, 1.87, 1.80, 1.72, 1.65, 1.57, 1.50, 1.42, 1.30, 1.20, 1
     4.12, 1.03, .95, .87, .77, .67, .60, .52, .42, .33, .23, .15, .05,
     5- .03, - .15, - .21, - .30, - .42, - .55, - .65, - .74, - .85, - .
     697, - 1.07, - 1.20, - 1.31, - 1.42, - 1.55, - 1.66, - 1.79, 37 ( -
     7 8.00))
      DATA((AL(I),I=110,216)
     X                   = 17 ( - 8.00), - .65, - .50, - .26, - .13, .05, .2
     10, .36, .50, .63, .73, .85, .97, 1.07, 1.17, 1.27, 1.37, 1.45, 1.5
     25, 1.64, 1.75, 1.84, 1.95, 2.05, 2.15, 2.28, 2.40, 2.46, 2.42, 2.2
     38, 2.16, 2.01, 1.75, 1.57, 1.48, 1.56, 1.67, 1.83, 1.98, 2.08, 2.1
     46, 2.32, 2.28, 2.29, 2.28, 2.26, 2.23, 2.17, 2.12, 2.06, 1.97, 1.8
     56, 1.76, 1.68, 1.50, 1.38, 1.27, 1.14, 1.03, .91, .82, .71, .61, .
     650, .41, .31, .22, .14, .07, - .02, - .12, - .21, - .28, - .40, -
     7.49, - .59, - .66, - .76, - .86, - .96, - 1.07, - 1.17, - 1.28, -
     81.40, - 1.50, - 1.63, - 1.76, - 1.88, - 2.00, - 2.14, - 2.29)
      DATA((AL(I),I=217,229)
     X                   = - 2.42, - 2.55, - 2.72, - 2.87, - 3.03, - 3.20, -
     1 3.38, - 3.55, - 3.69, - 3.85, - 4.03, - 4.22, - 4.41)
      DATA (FLTR = 229 (1.0))
      END
```

```
      SUBROUTINE DUMMY6
      COMMON /ALCALW/ ALC(229),ALW(229),ALOZ(229),OZMXR(19),OZPRS(19)
C*************************************************************************
C          LOG(L) TABLES FOR CO2, WINDOW, AND OZONE (FROM ELSASSER)
C*************************************************************************
      DATA (ALC = 56 (0.), - 4.97, - 4.05, - 3.30, - 2.63, - 2.06, - 1.5
     10, - 1.05, - .61, - .21, .16, .38, .43, .32, 0., - .34, - .72, - 1
     2.08, - 1.50, - 1.88, - 2.27, - 2.67, - 3.08, - 3.52, - 3.93, - 4.3
     39, - 4.83, 147 (0.))
      DATA (ALW = 68 (0.), - .81, - .71, - .73, - .75, - .76, - .77, - .
     178, - .80, - .81, - .83, - .84, - .86, - .87, - .89, - .91, - .92,
     2 - .94, - .95, - .97, - .99, - 1.01, - 1.02, - 1.04, - 1.06, - 1.0
     37, - 1.08, - 1.10, - 1.11, - 1.12, - 1.14, - 1.15, - 1.16, - 1.17,
     4 - 1.17, - 1.18, - 1.18, - 1.20, - 1.20, 4 ( - 1.21), - 1.22, 5 (
     5- 1.21), - 1.20, - 1.19, - 1.18, - 1.16, - 1.14, 108 (0.))
      DATA (ALOZ= 97(0.),-2.2,-1.4,-.8,-.4,-.05,.2,.3,.5,-.1,.5,.35,
     *-.7,-1.25,-1.3,-1.2,-1.,-1.3,-2.5, 114(0.))
C*************************************************************************
C          MIXING RATIO VS. PRESSURE TABLES FOR OZONE
C*************************************************************************
      DATA (OZPRS=1050.,1013.,615.,506.,356.,194.,145.,103.,55.,29.,
     * 23.7,16.0,13.,8.8,4.8,2.8,.6,.2,.1)
      DATA (OZMXR=0.0,3.9,7.4,8.4,9.0,15.,18.,43.,300.,733.,1037.,
     * 1154.,1180.,1103.,897.,702.,500.,370.,89.)
      END




      SUBROUTINE DUMMY7
      COMMON /TRANS /TWAI, TWAD, NTWA, TT (50), TCOI, TCOD, NTCO, TTC (7
     14),TOZI,TOZD,NTOZ,TTOZ(41)
C*************************************************************************
C          TAU TABLES FOR H2O VAPOR, CO2, AND OZONE (FROM ELSASSER)
C*************************************************************************
      DATA (TWAI = - 3.7), (TWAD = .1), (NTWA = 50)
      DATA (TT = 1., .999, .9967, .9932, .9887, .9833, .9772, .9705, .96
     133, .9556, .9475, .9389, .9298, .9200, .9094, .8978, .8851, .8711,
     2 .8556, .8384, .8194, .7984, .7753, .7500, .7225, .6928, .6610, .6
     3272, .5915, .5541, .5152, .4750, .4338, .3919, .3497, .3076, .2661
     4, .2258, .1874, .1518, .1198, .0920, .0687, .0500, .0357, .0250, .
     50168, .0103, .0049, .0)
      DATA (TCOI = - 5.2), (TCOD = .1), (NTCO = 74)
      DATA (TTC = 1., .9997, .9991, .9982, .9970, .9955, .9937, .9916, .
     19892, .9865, .9835, .9802, .9766, .9727, .9685, .9639, .959, .9538
     2, .9482, .9422, .9358, .929, .9218, .9141, .9059, .8972, .8879, .8
     378, .8674, .8561, .844, .831, .817, .8019, .7856, .768, .7491, .72
     488, .7071, .6839, .6592, .633, .6053, .5762, .5458, .5142, .4815,
     5.4478, .4133, .3782, .3428, .3075, .2727, .2389, .2066, .1763, .14
     684, .123, .1002, .0801, .0627, .048, .036, .0266, .0196, .0147, .0
     7113, .0089, .0071, .0056, .0042, .0028, .0014, .0)
      DATA (TOZI=-4.3),(TOZD=.1),(NTOZ=41)
      DATA (TTOZ= 1.,.992,.984,.976,.968,.96,.952,.944,.936,.927,.917,
     *.906,.894,.881,.866,.849,.83,.809,.786,.761,.734,.705,.673,
     *.683,.6,.559,.515,.468,.418,.366,.312,.257,.202,.151,.108,
     *.074,.048,.029,.015,.005,0.0)
      END
```

```
      SUBROUTINE PROFILE(M,NPTW,ALO,NU3)
      COMMON /PARAMS /ID (6), XMIN, XMAX, YMIN, YMAX, NCYC
      COMMON/PTW/XP(200),XT(200),X (200),TA(200)
      COMMON/MEANS/PBAR(15),TBAR(15),IHEAD(8)
      COMMON /PROF /RADC (15), RADN (15), NFRQL (15), NFRQU (15), NFRQ
      DIMENSION XX (15), DX (15), EE (15), XPE (15), TAE (15), XWE (15)
      DIMENSION KX (10), PBAR (15), TBAR (15)
      DIMENSION XTM (16, 15)
      A=357.9110836
  360 KX (1) = 1
      KX (2) = 1
      KX (3) = 1
      KX (4) = 0
      KX (5) = 10
      KX (6) = 500
      READ 1534, ID
 1534 FORMAT(8A10)
      READ 1534, IHEAD
      PRINT 1536, IHEAD
 1536 FORMAT (1H1,30X,8A10/)
      READ 1538, XMIN, XMAX, YMIN, YMAX
 1538 FORMAT (10F8.2)
      READ 1540, NCYC
 1540 FORMAT (I1)
      CALL TINIT (A, B, C, D)
      ME = 1
      READ 1540, MEX
      IF (MEX .EQ. 0) GO TO 385
      ME = 1
      PRINT 1542
 1542 FORMAT (/#   PRES.          TEMP.          W          EXACT#/)
  365 READ 1544, XPE (ME), TAE (ME), XWE (ME)
 1544 FORMAT (3F8.2)
      IF (XPE (ME))375, 375, 370
  370 TAE (ME) = TAE (ME) + 273.16
      PRINT 1548, XPE (ME), TAE (ME), XWE (ME)
      ME = ME + 1
      GO TO 365
  375 ME = ME - 1
      ME1 = ME - 1
      IF (ME1 .LT. 1) GO TO 475
      DO 380 I = 1, ME1
      PBAR (I) = .5 * (XPE (I) + XPE (I + 1))
  380 TBAR (I) = .5 * (TAE (I) + TAE (I + 1))
  475 CONTINUE
      CALL TPLOT (XPE, TAE, ME, 1)
  385 PRINT 1546
 1546 FORMAT (/#   PRES.          TEMP.          W     INITIAL GUESS#/)
      IF (NPTW .LT. 1) GO TO 480
      DO 390 I = 1, NPTW
      PRINT 1548, XP (I), TA (I), XW (I)
 1548 FORMAT (/F9.1,F12.2,F11.4)
  390 CONTINUE
  480 CONTINUE
      PRINT 1550, ALO
 1550 FORMAT (//* THETA = *,F5.1)
C  (PROCESS)
```

```
      PRINT 1552
 1552 FORMAT (//2H I,3X*FREQUENCIES*,2X*RADIANCE*/)
      READ 1554, NFRQ, NU3
 1554 FORMAT (I2,I4)
      IF (NFRQ .LT. 1) GO TO 485                                        **
      DO 400 I = 1, NFRQ
      READ 1556, NFRQL (I), NFRQU (I), RADO (I)
 1556 FORMAT (2I5,F15.9)
  395 PRINT 1558, I, NFRQL (I), NFRQU (I), RADO (I)
 1558 FORMAT (/I2,2I8,F14.9)
  400 CONTINUE                                                          **
  485 CONTINUE
      N = M - 1                                                         **
      IF (N .LT. 2) GO TO 490
      DO 405 I = 2, N
      XX (I - 1) = TA (I)
  405 DX (I - 1) = 10.                                                  **
  490 CONTINUE
      V = 0.
      KX (7) = KX (8) = KX (9) = KX (10) = 0
      NITER = 0
      Z = 1.
      CALL CALC (XX, EE, V)
      ASSIGN 410 TO KPRT
      GO TO 415
  410 ASSIGN 450 TO KPRT
      DO 455 NITER = 1, 20
      CALL MINMYZ (XX, DX, N - 1, EE, NFRQ, Z, KX, V, XTM)
  415 PRINT 1560, V, (KX (J), J = 7, 10), NITER
 1560 FORMAT (//*     P*,4X,*     T    U = *,E9.3,4I4,10X,*NITER = *,I2)
     1
      IF (N .LT. 2) GO TO 495                                           **
      DO 420 I = 2, N
  420 TA (I) = XX (I - 1)                                               **
  495 CONTINUE                                                          **
      IF (M .LT. 1) GO TO 500
      DO 435 I = 1, M
      IF ((I .EQ. M) .OR. (I .EQ. 1))425, 430
  425 PRINT 1562, XP (I), TA (I)
 1562 FORMAT (/F8.2,2F9.2,F14.9)
      GO TO 435
  430 PRINT 1562, XP (I), TA (I), DX (I), EE (I)
  435 CONTINUE                                                          **
  500 CONTINUE
      PRINT 1561
 1561 FORMAT(//*  PBAR        TBAR*)
      MM = M - 1
      IF (MM .LT. 1) GO TO 505                                          **
      DO 440 I = 1, MM
      TBAR (I) = .5 * (TA (I) + TA (I + 1))
      PRINT 1562, PBAR (I), TBAR (I)
  440 CONTINUE                                                          **
  505 CONTINUE
      CALL TPLOT (XP, TA, NPIW, 2)
  445 GO TO KPRT, (410, 450)
  450 IF ((NITER .GT. 2) .AND. (V .LE. 1.E-9)) GO TO 460
      IF (KX (10) .EQ. 0) GO TO 46
  455 CONTINUE
  460 CALL GRIPLT (0, 0, 0, 0, 20)
      RETURN
      END
```

```
      SUBROUTINE CALC (X, E, U)
      COMMON/PTW/XP(200),XI(200),XW(200),TA(200)
      COMMON /HEAD /ISTA, MDATE, NDATE, WL1, TWL2, IF1, IF2, FNU1, FNU2,
     1 NPAGE, DNU, NPTW, IBRITE
      COMMON /PARAMT /M, NANGLES, NU1, NU2, NU3, MK, LUDD, NCOSW, P, Q,
     1PI,LUD,NOZSW
      COMMON /WATERP /RNOBS, FZW, H2T, VLAMB
      COMMON /PROF /RADC (15), RADO (15), NFRQL (15), NFRQU (15), NFRQ
      COMMON /VALUE /AII
C
      DIMENSION X (15), E (15)
C
      N = M - 1
      IF (N .LT. 2) GO TO 110                                        **
      DO 100 I = 2, N
      TA (I) = X (I - 1)
      XI (I) = TA (I) - 273.16
  100 CONTINUE
  110 CONTINUE                                                       **
      U = 0.
      DNU = NU3
      IF (NFRQ .LT. 1) GO TO 115                                     **
      DO 105 NF = 1, NFRQ
      NU1 = NFRQL (NF)
      NU2 = NFRQU (NF)
      RNOBS = RADO (NF)
      CALL CALWAT (XI, FWZ, 2)
      RADVAL = FWZ
      RADC (NF) = AII
      E (NF) = RADVAL
      U = U + RADVAL * * 2
  105 CONTINUE
  115 CONTINUE                                                       **
      U = SQRT (U / NFRQ)
      RETURN
      END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      SUBROUTINE MINMYZ (Y, DX, NN, E, MM, W, KX, U, XTM)
      DIMENSION X (15), DX (15), E (15), EE (15), KX (10), DE (15), DDE
     1(15), XTM (16, 15), XTN (15, 15), XTNA (15, 16), DEL (15), Y (15)
      CLOSER (A, X, B) = AMIN1 (AMAX1 (AMIN1 (A, B), X), AMAX1 (A, B))
      VN = 0
      M = MM
      N = NN
      V = U
      Z = W
      IF (N .LT. 1) GO TO 450                                          **
      DO 100 L = 1, N
  100 X (L) = Y (L)                                                    **
  450 CONTINUE
      Z0 = Z
      V0 = V
      NUM = 0
      KX6 = KX (1)
      KX (7) = 0
      KX (8) = 0
      KX (9) = 1
      KX (10) = 0
      PER = 0.1 * FLOAT (KX (3))
      ZM = 0.001 * FLOAT (KX (5))
      Z = CLOSER (ZM, Z, 1.)
      FM = M
      DLM = KX (4)
      IF (DLM)110, 105, 110
  105 DLM = 100.                                                       **
  110 IF (N .LT. 1) GO TO 455
      DO 190 I = 1, N
      IF (DX (I))115, 190, 115
  115 NUM = NUM + 1
      X (I) = X (I) + DX (I)
      CALL CALC (X, EE, VN)
      D = 0.                                                           **
      IF (M .LT. 1) GO TO 460
      DO 120 L = 1, M
      XTM (L, NUM) = (EE (L) - E (L)) / DX (I)
  120 D = D + XTM (L, NUM) * * 2                                       **
  460 CONTINUE
      IF (D)125, 125, 135
  125 X (I) = X (I) - DX (I)
  130 DX (I) = 0.
      NUM = NUM - 1
      GO TO 190
  135 IF (VN - V)140, 155, 155
  140 IF (M .LT. 1) GO TO 465                                          **
      DO 145 L = 1, M
  145 E (L) = EE (L)                                                   **
  465 CONTINUE
      KX (8) = 1
      BET = 100. * (V - VN) / V
      V = VN
      IF (BET - PER)190, 150, 150
  150 KX (7) = 1
      GO TO 190
  155 DX (I) = - DX (1)
```

```
      IF (D, M)160, 160, 165
160   X (I) = X (I) + DX (I)
      GO TO 190
165   X (I) = X (I) + DX (I) * 2.
      CALL CALC (X, EE, VN)
      D = 0.
      IF (M .LT. 1) GO TO 470
      DO 170 L = 1, M
      XTM (L, NUM) = (EE (L) - E (L)) / DX (I)
170   D = D + XTM (L, NUM) * * 2
470   CONTINUE
      IF (D)175, 175, 180
175   X (I) = X (I) - DX (I)
      GO TO 130
180   IF (VN - V)140, 185, 185
185   X (I) = X (I) - DX (I)
      DX (I) = DX (I) * .5
190   CONTINUE
455   CONTINUE
      IF (NUM)195, 195, 210
195   KX (9) = - 1
      GO TO 420
C        ORIGINAL MINMY DECK INSERTED HERE.
200   IF (M .LT. 1) GO TO 475
      DO 205 LL = 1, M
205   EE (LL) = XTM (LL, NUM + 1) * E (LL)
475   CONTINUE
      GO TO 270
210   IF (M .LT. 1) GO TO 480
      DO 220 LL = 1, M
215   EE (LL) = ABS (E (LL))
220   XTM (LL, NUM + 1) = 1.
480   CONTINUE
      CALL SORT (EE, M)
      EMX = EE (M)
      EMN = EE (M + 1 - NUM)
      IF (EMN .EQ. 0) GO TO 225
      IF (1000. * EMN - EMX)235, 225, 225
225   IF (M .LT. 1) GO TO 485
      DO 230 LL = 1, M
230   EE (LL) = E (LL)
485   CONTINUE
      GO TO 255
235   EX = 2.9077553 / ALOG (EMX / EMN) - 1.
      IF (M .LT. 1) GO TO 490
      DO 250 LL = 1, M
      IF (ABS (E (LL)) - EMN)250, 250, 240
240   FAC = (ABS (E (LL) / EMN)) * * EX
      IF (NUM .LT. 1) GO TO 495
      DO 245 KK = 1, NUM
245   XTM (LL, KK) = FAC * XTM (LL, KK)
495   CONTINUE
      XTM (LL, NUM + 1) = FAC
250   EE (LL) = XTM (LL, NUM + 1) * E (LL)
490   CONTINUE
255   IF (NUM .LT. 1) GO TO 500
      DO 260 II = 1, NUM
```

```
      IF (NUM .LT. II) GO TO 505                                    **
      DO 265 J = II, NUM
      XTN (II, J) = 0.
      IF (M .LT. 1) GO TO 510                                       **
      DO 260 KK = 1, M
260   XTN (II, J) = XTN (II, J) + XTM (KK, II) * XTM (KK, J)
510   CONTINUE                                                      **
265   XTN (J, II) = XTN (II, J)
505   CONTINUE                                                      **
500   CONTINUE                                                      **
270   IF (NUM .LT. 1) GO TO 515                                     **
      DO 275 LL = 1, NUM
      XTNA (LL, NUM + 1) = 0.
      IF (M .LT. 1) GO TO 520                                       **
      DO 275 II = 1, M
275   XTNA (LL, NUM + 1) = XTNA (LL, NUM + 1) - XTM (II, LL) * EE (II)
520   CONTINUE                                                      **
515   CONTINUE                                                      **
      IF (NUM .LT. 1) GO TO 525                                     **
      DO 280 II = 1, NUM
      IF (NUM .LT. 1) GO TO 530                                     **
      DO 280 J = 1, NUM
280   XTNA (II, J) = XTN (II, J)
530   CONTINUE                                                      **
525   CONTINUE                                                      **
      CALL GAUSSEL (XTNA, 15, NUM, NUM + 1, LDL)
      IF (LDL - NUM)285, 290, 285
285   KX (9) = 0
      PRINT 1500, NUM, LDL
1500  FORMAT (≠ SINGULAR MATRIX, ORDER≠,I2,≠, RANK≠I2≠.≠)           **
      GO TO 420
290   NS = 0
295   IF (N .LT. 1) GO TO 535                                       **
      DO 305 K = 1, N
      DEL (K) = 0.
      IF (DX (K))300, 305, 300
300   NS = NS + 1
      DLMDX = ABS (DLM * DX (K))
      DEL (K) = CLOSER ( - DLMDX, XTNA (NS, NUM + 1), DLMDX)
      XTNA (NS, NUM + 1) = DEL (K)
305   CONTINUE
535   CONTINUE                                                      **
      ZZ = 7
310   IF (N .LT. 1) GO TO 540                                       **
      DO 315 K = 1, N
315   X (K) = X (K) + ZZ * DEL (K)
540   CONTINUE                                                      **
      CALL CALC (X, EE, VN)
      A = 0.
      B = 0.
      C = 0.
      D = 0.
      IF (M .LT. 1) GO TO 545                                       **
      DO 325 I = 1, M
      DE (I) = 0.
      IF (NUM .LT. 1) GO TO 550                                     **
      DO 320 K = 1, NUM
```

```
320   DE (I) = DE (I) + XTM (I, K) * XTNA (K, NUM + 1)
550   CONTINUE                                                              **
      DDE (I) = (EE (I) - E (I) - Z * DE (I)) / Z * * 2
      A = A + DE (I) * DDE (I)
      B = B + DE (I) * DE (I) + 2. * E (I) * DDE (I)
      C = C + E (I) * DE (I)
325   D = D + DDE (I) * * 2
545   CONTINUE                                                              **
      A = 3.0 * A
      D = D + D
      ZP = - C / B
      DO 330 I = 1, 10
      DZ = (C + ZP * (B + ZP * (A + ZP * D))) / (B + ZP * (A + A + 3. *
     1ZP * D))
      ZP = ZP - DZ
      IF (ABS (DZ) - 0.0001)335, 335, 330
330   CONTINUE
335   ZP = CLOSER (ZM, ZP, 1.0)
      SQE = 0.
      IF (M .LT. 1) GO TO 555                                               **
      DO 340 I = 1, M
340   SQE = SQE + (E (I) + ZP * (DE (I) + ZP * DDE (I))) * * 2
555   CONTINUE                                                              **
      VP = SQRT (SQE / FM)
345   BET = (V - VN) / V * 100.
350   IF (BET)370, 370, 355
355   V = VN
      KX (8) = 1
      IF (M .LT. 1) GO TO 560                                               **
      DO 360 I = 1, M
360   E (I) = EE (I)
560   CONTINUE                                                              **
      IF (BET - PER)375, 365, 365
365   Z = ZP
      KX (7) = 1
      KX6 = KX6 - 1
      IF (KX6)410, 410, 200
370   KX6 = KX6 - KX (2)
      IF (KX6)430, 430, 440
375   KX6 = KX6 - KX (2)
      IF (KX6)410, 410, 380
380   IF (100. * (V - VP) / V - PER)410, 385, 385
385   ZZ = ZP - Z
      IF (ZZ)390, 410, 405
390   ZZ = - ZZ
      IF (N .LT. 1) GO TO 565                                               **
      DO 395 K = 1, N
395   DEL (K) = - DEL (K)                                                   **
565   CONTINUE                                                              **
      IF (NUM .LT. 1) GO TO 570                                             **
      DO 400 K = 1, NUM
400   XTNA (K, NUM + 1) = - XTNA (K, NUM + 1)
570   CONTINUE                                                              **
405   Z = ZZ
      GO TO 310
410   Z = ZP
      KX (10) = 1000. * (V0 - V) / V0
```

```
      IF (KY (10) - KX (6))420, 415, 415
415   Z = ZP                                                  **
420   IF (N .LT. 1) GO TO 575
      DO 425 L = 1, N
425   Y (L) = X (L)                                           **
575   CONTINUE
      U = V
      W = Z
      RETURN                                                  **
430   IF (N .LT. 1) GO TO 580
      DO 435 I = 1, N
435   X (I) = X (I) - Z * DEL (I)                             **
580   CONTINUE
      GO TO 410
440   IF (100. * (V - VP) / V - PE )430, 445, 445
445   ZZ = ZP - Z
      Z = ZP
      GO TO 310
      END
```

```
      SUBROUTINE GAUSSEL (C, NRD, NRR, NCC, NSF)
      DIMENSION C (15, 16), L (16, 2)
      BITS = 2. * * ( - 18)
      NR = NRR
      NC = NCC
C     INITIALIZE.
      NSF = 0
      NRM = NR - 1
      NRP = NR + 1
      D = 1.
      LSD = 1
      IF (NR .LT. 1) GO TO 225                                      **
      DO 100 KR = 1, NR
      L (KR, 1) = KR
  100 L (KR, 2) = 0
  225 CONTINUE                                                      **
      IF (NR - 1)105, 155, 105
C     ELIMINATION PHASE.
  105 IF (NRM .LT. 1) GO TO 230                                     **
      DO 150 KP = 1, NRM
      KPP = KP + 1
      PM = 0.
      MPN = 0
C     SEARCH COLUMN KP FROM DIAGONAL DOWN, FOR MAX PIVOT.
      IF (NR .LT. KP) GO TO 235                                     **
      DO 115 KR = KP, NR
      LKR = L (KR, 1)
      PT = ABS (C (LKR, KP))
      IF (PT - PM)115, 115, 110
  110 PM = PT
      MPN = KR
      LMP = LKR
  115 CONTINUE
  235 CONTINUE                                                      **
C     IF MAX PIVOT IS ZERO, MATRIX IS SINGULAR.
      IF (MPN)120, 215, 120
  120 NSF = NSF + 1
      IF (MPN - KP)125, 130, 125
C     NEW ROW NUMBER KP HAS MAX PIVOT.
  125 LSD = - LSD
      L (MPN, 1) = L (KP, 1)
      L (KP, 2) = L (MPN, 1)
      L (KP, 1) = LMP
C     ROW OPERATIONS TO ZERO COLUMN KP BELOW DIAGONAL.
  130 MKP = L (KP, 1)
      P = C (MKP, KP)
      D = D * P
      IF (NR .LT. KPP) GO TO 240                                    **
      DO 150 KR = KPP, NR
      MKR = L (KR, 1)
      Q = C (MKR, KP) / P
      IF (Q)135, 150, 135
C     SUBTRACT Q * PIVOT ROW FROM ROW KR.
  135 IF (NC .LT. KPP) GO TO 245                                    **
      DO 145 LC = KPP, NC
      R = Q * C (MKP, LC)
      C (MKR, LC) = C (MKR, LC) - R
```

```
      IF (ABS (C (MKR, LC)) - ABS (R) * BITS)140, 145, 145
 140  C (MKR, LC) = 0.
 145  CONTINUE
 245  CONTINUE
 150  CONTINUE
 240  CONTINUE
 230  CONTINUE
C     LOWER RIGHT HAND CORNER.
 155  LNR = L (NR, 1)
      P = C (LNR, NR)
      IF (P)160, 215, 160
 160  NSF = NSF + 1
      D = D * P * LSD
      IF (NR - NC)165, 210, 165
C     BACK SOLUTION PHASE.
 165  IF (NC .LT. NRP) GO TO 250
      DO 190 MC = NRP, NC
      C (LNR, MC) = C (LNR, MC) / P
      IF (NR - 1)170, 190, 170
 170  IF (NRM .LT. 1) GO TO 255
      DO 185 LL = 1, NRM
      KR = NR - LL
      MR = L (KR, 1)
      KRP = KR + 1
      IF (NR .LT. KRP) GO TO 260
      DO 180 MS = KRP, NR
      LMS = L (MS, 1)
      R = C (MR, MS) * C (LMS, MC)
      C (MR, MC) = C (MR, MC) - R
      IF (ABS (C (MR, MC)) - ABS (R) * BITS)175, 180, 180
 175  C (MR, MC) = 0.
 180  CONTINUE
 260  CONTINUE
 185  C (MR, MC) = C (MR, MC) / C (MR, KR)
 255  CONTINUE
 190  CONTINUE
 250  CONTINUE
C     SHUFFLE SOLUTION ROWS BACK TO NATURAL ORDER.
      IF (NRM .LT. 1) GO TO 265
      DO 205 LL = 1, NRM
      KR = NR - LL
      MKR = L (KR, 2)
      IF (MKR)195, 205, 195
 195  MKP = L (KR, 1)
      IF (NC .LT. NRP) GO TO 270
      DO 200 LC = NRP, NC
      Q = C (MKR, LC)
      C (MKR, LC) = C (MKP, LC)
 200  C (MKP, LC) = Q
 270  CONTINUE
 205  CONTINUE
 265  CONTINUE
C     NORMAL AND SINGULAR RETURNS.  GOOD SOLUTION COULD HAVE D=0.
 210  C (1, 1) = D
      GO TO 220
 215  C (1, 1) = 0.
 220  RETURN



 115            END
```

```
      SUBROUTINE SORT(SS,N)
      DIMENSION SS(20)
      MO=N
    2 IF(MO-15)21,21,23
   21 IF(MO-1)9,9,22
   22 MO=2*(MO/4)+1
      GO TO 24
   23 MO=2*(MO/8)+1
   24 KO=N-MO
      JO=1
   25 I=JO
   26 IP=I+MO
      IF(SS(I)-SS(IP))28,28,27
   27 TT=SS(I)
      SS(I)=SS(IP)
      SS(IP)=TT
      I=I-MO
      IF(I-1)28,26,26
   28 JO=JO+1
      IF(JO-KO)25,25,2
    9 RETURN
      END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      SUBROUTINE PIPLOT (PP, I, N, MC)
C
      COMMON /PARAMS /ID, XMIN, XMAX, YMIN, YMAX, NCYC
      COMMON/MEANS/PBAR(15),IBAR(15),IHEAD(8)
C
      DIMENSION ID (6), XS (2), YS (2), XB (2), YB (2)
      DIMENSION NXH (6), NXT (6), NVT (6), NHT (6)
      DIMENSION XN (200), YN (200)
      DIMENSION PP (200), I (200)
      DIMENSION IVERT(3),IHORIZ(3)
C
C
      DATA (XS = 165., - 15.), (YS = 165., - 15.)
      DATA (XB = 0., 150.), (YB = 0., 150.)
      DATA (NXH = 1, 1, 0, 0, 0, 1)
      DATA (NXT = 8, 1, 0, 0, 0, 2), (NVT = 3, 1, 1, 0, 0, 2), (NHT = 3,
     1 1, 0, 0, 0, 2)
      DATA(IVERT=10H      P+9R,10HESSURE+1(+,10H9MB+1)     )
      DATA(IHORZ=10H     T+9EMP,10HERATURE+1(,10H+9*+1K)    )
      ENTRY TINIT
C                               BORDER
      CALL GRIPLT (XS, YS, 0, ID, )
      CALL GRIPLT (XB, YB, 0, 1, 1-)
C                               HEADINGS
      CALL GRIPLT ( - 15., 162.5, NXT, IHEAD, 10)
      CALL GRIPLT ( - 15., 50., NVT, IVERT, 10)
      CALL GRIPLT (50., - 15., NHT, IHORZ, 10)
C                               X TIC MARKS
      AH = 150. / (XMAX - XMIN)
      BH = - AH * XMIN
      CALL GRIPLT (0, 0, 3H-0-, 3, 5)
      DO 100 I = 1, 9
      XX = 15 * I
      CALL GRIPLT (XX, 0., 1, 1, 1)
      CALL GRIPLT (XX, 150., 1, 1, 1)
  100 CONTINUE
C                               Y TIC MARKS
      NVPATH = 1
      IF (NCYC .EQ. 0) NVPATH = 2
      GO TO (105, 110), NVPATH
  105 XVMAX = ALOG10 (YMAX)
      XVMIN = ALOG10 (YMIN)
      GO TO 115
  110 XVMAX = YMAX
      XVMIN = YMIN
  115 AV = 150. / (XVMAX - XVMIN)
      BV = - AV * XVMIN
      CALL GRIPLT (0, 0, 3H+0-, 3, 5)
      P = YMIN
      GO TO (120, 135), NVPATH
  120 DP = P * .1
      IF (NCYC .LT. 1) GO TO 235                                     **
      DO 130 NC = 1, NCYC
      DO 125 I = 1, 9
      IF ((I .EQ. 9) .AND. (NC .EQ. NCYC)) GO TO 130
      P = P - DP
      PV = ALOG10 (P)
```

```
      YY = AV * PV + BV
      CALL CRIPLT (0, YY, 1, 1, 1)
      CALL CRIPLT (150., YY, 1, 1, 1)
  125 CONTINUE
      P = DP
      DP = P * .1
  130 CONTINUE
  235 CONTINUE                                                    **
      GO TO 145
  135 DP = 100.
      DO 140 I = 1, 6
      P = P - DP
      YY = AV * P + BV
      CALL CRIPLT (0, YY, 1, 1, 1)
  140 CALL CRIPLT (150., YY, 1, 1, 1)
C                                  X SCALE VALUES
  145 DX = (XMAX - XMIN) * .2
      DO 150 I = 1, 6
      XV = XMIN + (I - 1) * DX
      XX = 30 * (I - 1) - 3
      ENCODE (5, 1500, III)XV
 1500 FORMAT (F5.0)
      CALL CRIPLT (XX, - 5., NXH, III, 10)
  150 CONTINUE
C                                  Y SCALE VALUES
      GO TO (155, 165), NVPATH
  155 DY = 150. / NCYC
      NCP = NCYC + 1
      P = YMIN * 10.
      IF (NCP .LT. 1) GO TO 240                                   **
      DO 160 I = 1, NCP
      P = P * .1
      YV = ALOG10 (P)
      YV = AV * YV + BV
      ENCODE (4, 1502, III)P
 1502 FORMAT (F6.1)
      CALL CRIPLT ( - 12., YV, NXH, III, 10)
  160 CONTINUE
  240 CONTINUE                                                    **
      RETURN
  165 DY = 100.
      P = 1600.
      DO 170 I = 1, 8
      YY = P - (I - 1) * DY
      YV = AV * YY + BV
      ENCODE (5, 1500, III)YY
  170 CALL CRIPLT ( - 10., YV, NXH, III, 10)
      RETURN
C
      ENTRY TPLOT
      M = N + 1
      GO TO (175, 180), MC
  175 CALL CRIPLT (0, 0, 3H+0X, 1, 5)
      GO TO 185
  180 CALL CRIPLT (0, 0, 3H+00, 1, 5)
  185 IF (M .LT. 1) GO TO 245                                     **
      DO 230 I = 1, M
```

```
      IF (I .EQ. 1)190, 195
190   PVAL = PP (1)
      TVAL = T (1)
      GO TO 210
195   IF (I .EQ. M)200, 205
200   PVAL = PP (I - 1)
      TVAL = T (I - 1)
      GO TO 210
205   PVAL = PBAR (I - 1)
      TVAL = TBAR (I - 1)
210   XN (I) = AH * TVAL + BH
      GO TO (215, 220), NVPAIH
215   YN (I) = AV * ALOG10 (PVAL) + BV
      GO TO 225
220   YN (I) = AV * PVAL + BV
225   CALL FRIPLT (XN (I), YN (I), 1, 1, 1)
230   CONTINUE
245   CONTINUE                                                        **
      CALL FRIPLT (0, 0, 0, 0, 8)
      CALL FRIPLT (XN, YN, M, 1, 1)
      RETURN
      END
```